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VOLUME 22 / NUMBER 13
JULY 8, 1984
ACC. NOS. N84-22527 TO N84-23550

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Scientific and Technical Aerospace Reports, Volume 22, is prepared by the NASA Scientific and Technical Information Facility operated for the National Aeronautics and Space Administration by PRC Government Information Systems.

The Administrator of the National Aeronautics and Space Administration has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Agency. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through February 28, 1985.

US ISSN 0036-8741

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Subject scope of *STAR*, and *IAA* includes all aspects of aeronautics and space research and development, supporting basic and applied research, and applications. Aerospace aspects of earth resources, energy development, conservation, oceanography, environmental protection, urban transportation, and other topics of high national priority are also covered.

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AERONAUTICS

Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

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Abstracts in *STAR* are grouped by specific category, the categories appearing in sequential order. Category breaks in the abstract section are identified by the category number and title, and a scope note. Cross-references to other categories are provided as appropriate. For example:

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Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

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VOLUME 22 NUMBER 13/JULY 8, 1984

TABLE OF CONTENTS

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For related information see also *Astronautics*.

01 AERONAUTICS (GENERAL) 1925

02 AERODYNAMICS 1925

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*

03 AIR TRANSPORTATION AND SAFETY 1928

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION 1929

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command and Tracking* and *32 Communications*.

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE 1930

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

06 AIRCRAFT INSTRUMENTATION 1931

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

07 AIRCRAFT PROPULSION AND POWER 1931

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

08 AIRCRAFT STABILITY AND CONTROL 1934

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

09 RESEARCH AND SUPPORT FACILITIES (AIR) 1935

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

ASTRONAUTICS

Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.

For related information see also *Aeronautics*

12 ASTRONAUTICS (GENERAL) 1936

For extraterrestrial exploration see *91 Lunar and Planetary Exploration*.

13 ASTRODYNAMICS N.A.

Includes powered and free-flight trajectories; and orbit and launching dynamics.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE) 1937

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and simulators.

For related information see also *09 Research and Support Facilities (Air)*.

15 LAUNCH VEHICLES AND SPACE VEHICLES 1937

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

16 SPACE TRANSPORTATION 1938

Includes passenger and cargo space transportation, e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

17 SPACECRAFT COMMUNICATION, COMMAND AND TRACKING 1938

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE 1938

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

19 SPACECRAFT INSTRUMENTATION N.A.

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

20 SPACECRAFT PROPULSION AND POWER 1941

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion and Power*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

CHEMISTRY AND MATERIALS

Includes chemistry and materials (general); composite materials; inorganic and physical chemistry; metallic materials; nonmetallic materials; and propellants and fuels.

23 CHEMISTRY AND MATERIALS (GENERAL) **1952**
Includes biochemistry and organic chemistry.

24 COMPOSITE MATERIALS **1953**
Includes laminates.

25 INORGANIC AND PHYSICAL CHEMISTRY **1955**
Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.
For related information see also *77 Thermodynamics and Statistical Physics.*

26 METALLIC MATERIALS **1960**
Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

27 NONMETALLIC MATERIALS **1961**
Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

28 PROPELLANTS AND FUELS **1965**
Includes rocket propellants, igniters, and oxidizers; storage and handling; and aircraft fuels.
For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

ENGINEERING

Includes engineering (general); communications; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.
For related information see also *Physics.*

31 ENGINEERING (GENERAL) **1967**
Includes vacuum technology; control engineering; display engineering; and cryogenics.

32 COMMUNICATIONS **1975**
Includes land and global communications; communications theory; and optical communications.
For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

33 ELECTRONICS AND ELECTRICAL ENGINEERING **1985**
Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuity.
For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics.*

34 FLUID MECHANICS AND HEAT TRANSFER **1988**
Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.
For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

35 INSTRUMENTATION AND PHOTOGRAPHY **1992**
Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.
For aerial photography see *43 Earth Resources.* For related information see also *06 Aircraft Instrumentation* and *19 Spacecraft Instrumentation.*

36 LASERS AND MASERS **1994**
Includes parametric amplifiers.

37 MECHANICAL ENGINEERING **1997**
Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

38 QUALITY ASSURANCE AND RELIABILITY **1999**
Includes product sampling procedures and techniques; and quality control.

39 STRUCTURAL MECHANICS **2000**
Includes structural element design and weight analysis; fatigue; and thermal stress.
For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance.*

GEOSCIENCES

Includes geosciences (general); earth resources; energy production and conversion; environment pollution; geophysics; meteorology and climatology; and oceanography.
For related information see also *Space Sciences.*

42 GEOSCIENCES (GENERAL) **N.A.**

43 EARTH RESOURCES **2003**
Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.
For instrumentation see *35 Instrumentation and Photography.*

44 ENERGY PRODUCTION AND CONVERSION **2007**
Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.
For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

45 ENVIRONMENT POLLUTION **2010**
Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

46 GEOPHYSICS **2010**
Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.
For space radiation see *93 Space Radiation.*

47 METEOROLOGY AND CLIMATOLOGY **2016**
Includes weather forecasting and modification.

48 OCEANOGRAPHY **2018**
Includes biological, dynamic and physical oceanography; and marine resources.

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51 LIFE SCIENCES (GENERAL) **2019**
Includes genetics.

52 AEROSPACE MEDICINE **2019**
Includes physiological factors; biological effects of radiation; and weightlessness.

53 BEHAVIORAL SCIENCES **2021**
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Includes human engineering; biotechnology; and space suits and protective clothing.

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59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL) **N.A.**

60 COMPUTER OPERATIONS AND HARDWARE **2024**
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61 COMPUTER PROGRAMMING AND SOFTWARE **2025**
Includes computer programs, routines, and algorithms.

62 COMPUTER SYSTEMS **2030**
Includes computer networks.

63 CYBERNETICS **2031**
Includes feedback and control theory.
For related information see also *54 Man/System Technology and Life Support.*

64 NUMERICAL ANALYSIS **2031**
Includes iteration, difference equations, and numerical approximation.

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66 SYSTEMS ANALYSIS **2037**
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67 THEORETICAL MATHEMATICS **2038**
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Includes physics (general); acoustics; atomic and molecular physics; nuclear and high-energy physics; optics; plasma physics; solid-state physics; and thermodynamics and statistical physics.
For related information see also *Engineering.*

70 PHYSICS (GENERAL) **2038**
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75 PLASMA PHYSICS **2044**
Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics.* For space plasmas see *90 Astrophysics.*

76 SOLID-STATE PHYSICS **2046**
Includes superconductivity.
For related information see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

77 THERMODYNAMICS AND STATISTICAL PHYSICS **2049**
Includes quantum mechanics; and Bose and Fermi statistics.
For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

SOCIAL SCIENCES

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law and political science; and urban technology and transportation.

80 SOCIAL SCIENCES (GENERAL) **2049**
Includes educational matters.

81 ADMINISTRATION AND MANAGEMENT **2049**
Includes management planning and research.

82 DOCUMENTATION AND INFORMATION SCIENCE 2066
Includes information storage and retrieval technology; micrography; and library science.
For computer documentation see *61 Computer Programming and Software.*

83 ECONOMICS AND COST ANALYSIS N.A.
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE N.A.
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION N.A.
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences.*

88 SPACE SCIENCES (GENERAL) 2069

89 ASTRONOMY 2069
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 2071
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 2072
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance.* For space stations see *15 Launch Vehicles and Space Vehicles.*

92 SOLAR PHYSICS 2091
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 2092
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine.* For theory see *73 Nuclear and High-Energy Physics.*

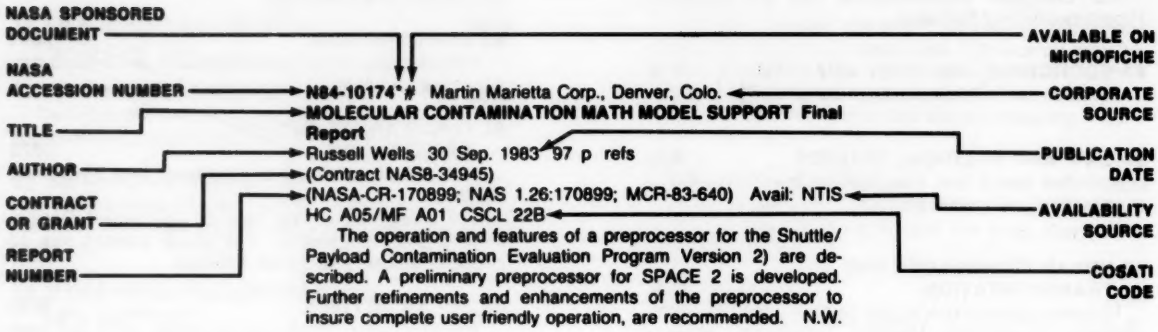
GENERAL

99 GENERAL N.A.

Note: N.A. means that no abstracts were assigned to this category for this issue.

SUBJECT INDEX I-1
PERSONAL AUTHOR INDEX I-57
CORPORATE SOURCE INDEX I-65
CONTRACT NUMBER INDEX I-77
REPORT/ACCESSION NUMBER INDEX I-79

TYPICAL CITATION AND ABSTRACT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N84-10174*# Martin Marietta Corp., Denver, Colo.
MOLECULAR CONTAMINATION MATH MODEL SUPPORT Final Report
Russell Wells 30 Sep. 1983 97 p refs
(Contract NAS8-34945)
(NASA-CR-170899; NAS 1.26:170899; MCR-83-640) Avail: NTIS
HC A05/MF A01 CSCL 22B
The operation and features of a preprocessor for the Shuttle/ Payload Contamination Evaluation Program Version 2) are described. A preliminary preprocessor for SPACE 2 is developed. Further refinements and enhancements of the preprocessor to insure complete user friendly operation, are recommended. N.W.

VOLUME 22 NUMBER 13/JULY 8, 1984

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERONAUTICS (GENERAL)

N84-22527*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYSIS OF INVISCID AND VISCOUS FLOWS IN CASCADES WITH AN EXPLICIT MULTIPLE-GRID ALGORITHM
Rodrick V. Chima 1984 14 p refs Proposed for presentation at the 17th Fluid Dyn., Plasma Dyn., and Lasers Conf., Snowmass, Colo., 25-27 Jun. 1984; sponsored by AIAA
(NASA-TM-83636; E-2078; NAS 1.15:83636) Avail: NTIS HC A02/MF A01 CSCL 20D

A rapid technique is used for calculating inviscid and viscous flows in turbomachinery cascades. The Euler and thin-layer Navier-Stokes equations are solved using the original explicit MacCormack algorithm. The Baldwin-Lomax eddy viscosity model is used for turbulent flows. Convergence to a steady state is accelerated by use of a variable time-step and a multiple-grid scheme. Computer time is reduced through vectorization. Details of the numerical method are presented along with computed results for two low-speed wind tunnel turning vanes, a space shuttle fuel pump turbine rotor, and a supersonic inflow compressor rotor. The method can predict subtle viscous flow phenomena in cascades and is fast enough to be used as a design tool. M.A.C.

N84-22528# Boeing Aerospace Co., Seattle, Wash.
INTEGRATED TESTING AND MAINTENANCE TECHNOLOGIES Final Technical Report, 25 Sep. 1981 - 15 Sep. 1983
R. O. Denney, M. J. Partridge, and R. B. Williams Wright-Patterson AFB, Ohio AFWAL Dec. 1983 323 p
(Contract F33615-81-C-1517; AF Proj. 2003)
(AD-A138587; AFWAL-TR-83-1183) Avail: NTIS HC A14/MF A01 CSCL 05/1

Maintenance of weapon systems is becoming an increasingly important consideration in weapon system development, because the cost of maintenance is a significant portion of the life cycle cost of the system. The objective of the Integrated Testing and Maintenance Technologies effort is to define requirements for an onboard test system for the avionic suite planned for tactical fighters in the 1990's. Problems with current onboard test systems were analyzed to determine where improvements could be made. In addition, the anticipated avionic architecture and mission of the 1990's were evaluated to determine the impact on maintenance capability. Requirements for the Integrated Testing and Maintenance System were developed and documented in a system specification. Identified improvements over current systems include better filtering of intermittent failure reports, better isolation of intermittent failures through the use of recorded data, more extensive use of system-level tests of mission operational data and a man-machine interface providing more information to the maintenance technician. In addition, artificial intelligence applications were evaluated to determine where they might be effectively applied to ITM. A design concept for a fault classification expert system was developed. Author (GRA)

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N84-22529 Princeton Univ., N. J.
TRANSONIC FLOW CALCULATIONS USING TRIANGULAR FINITE ELEMENTS Ph.D. Thesis
Richard Bruce Pelz 1983 135 p Previously announced as A83-39376
Avail: Univ. Microfilms Order No. DA8402695

A description is given of a technique for finding the numerical solution of the Full Potential equation for steady transonic flow about airfoils. The exterior but finite domain is discretized by breaking it up into triangles. Difference equations are formulated using variational principle and a formula for the derivative in a arbitrary polygon. The iterative schemes include multigrid-ADI for structured grids and modified checkerboard for more arbitrary grids. Results show consistency and compare favorably with codes using quadrilateral elements. Author (IAA)

N84-22530 Virginia Polytechnic Inst. and State Univ., Blacksburg.
THREE-DIMENSIONAL NONEQUILIBRIUM VISCOUS SHOCK-LAYER FLOW OVER THE SPACE SHUTTLE ORBITER Ph.D. Thesis
Mood Do Kim 1983 129 p Previously announced as A84-22149
Avail: Univ. Microfilms Order No. DA8402796

A numerical method was developed to predict the three dimensional nonequilibrium flowfield past the space shuttle orbiter at high angles of attack (up to 50-deg). An existing viscous shock layer method for perfect gas flows has been extended to include finite rate chemical reactions of multi-component ionizing air. A general nonorthogonal computational grid system was introduced to treat the nonaxisymmetric geometry. At shuttle reentry flight conditions, nonequilibrium real gas effects on the surface-measurable quantities are significant. Computational solutions were obtained for chemically reacting flowfields over the entire windward surface of the space shuttle orbiter at high angles-of-attack. Boundary conditions studied include noncatalytic wall, finite-catalytic wall, fully-catalytic wall, and nonequilibrium slip conditions at the wall and/or shock. The nonequilibrium solutions with a finite-catalytic wall are compared to both fully-catalytic and noncatalytic wall solutions. Dissert. Abstr.

N84-22531 Virginia Polytechnic Inst. and State Univ., Blacksburg.
CALCULATION OF THE FLOW OVER A STALLED AIRFOIL Ph.D. Thesis
Jerre Miller Hill 1983 134 p
Avail: Univ. Microfilms Order No. DA8402794

An approximate method for calculating the steady, incompressible, viscous flow over an airfoil, including regions of separated flow, is presented. The finite-difference equations

resulting from an integral method for the laminar and turbulent boundary layers are solved simultaneously in a line-relaxation procedure with the equations for the outer, inviscid flow. These coupled equations allow direct interaction between the viscous and inviscid regions, thus eliminating the mathematical difficulties usually associated with separation. A distributed source on the upper surface of the airfoil provides an outflow to simulate the displaced boundary, and a distributed sink downstream of the trailing edge closes the wake. Computed results, which are compared with measurements for an NACA 4412 airfoil, are quite satisfactory for engineering purposes. Dissert. Abstr.

N84-22532*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

V/STOL CONCEPTS IN THE UNITED STATES: PAST, PRESENT, AND FUTURE

W. P. Nelms and S. B. Anderson Apr. 1984 47 p refs
(NASA-TM-85938; A-9695; NAS 1.15:85938) Avail: NTIS HC A03/MF A01 CSCL 01A

Nonhelicopter types of V/STOL aircraft developed in the United States are reviewed, and some lessons learned from a selected number of concepts are highlighted. The AV-8B, which was developed by modifications to the British Harrier is the only current concept examined. Configurations proposed for the future subsonic, multimissing aircraft and the future supersonic fighter/attack aircraft are described. Emphasis is on these supersonic concepts. A.R.H.

N84-22533*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

REDESIGN AND CASCADE TESTS OF A SUPERCRITICAL CONTROLLED DIFFUSION STATOR BLADE-SECTION

James F. Schmidt, Thomas F. Gelder, and Leo F. Donovan 1984 13 p refs Proposed for presentation at the 20th Joint Propulsion Conf., Cincinnati, 11-13 Jun. 1984; sponsored by AIAA, SAE and ASME
(NASA-TM-83635; E-2077; NAS 1.15:83635) Avail: NTIS HC A02/MF A01 CSCL 01A

A supercritical stator blade section, previously tested in cascade, and characterized by a flat-roof-top suction surface Mach number distribution, has been redesigned and retested. At near design conditions, the losses and air turning were improved over the original blade by 50 percent and 7 percent respectively. The key element in the improved performance was a small blade reshaping. This produced a continuous flow acceleration over the first one-third chord of the suction surface which successfully prevented a premature laminar separation bubble. Several recently available inviscid analysis and one fully viscous (Navier-Stokes) analysis code were used in the redesign process. The validity of these codes was enhanced by the test results. Author

N84-22534*# Southampton Univ. (England). Dept. of Aeronautics and Astronautics.

THE DESIGN AND OPERATIONAL DEVELOPMENT OF SELF-STREAMLINING 2-DIMENSIONAL FLEXIBLE WALLED TEST SECTIONS Ph.D. Thesis

Stephen W. D. Wolf Mar. 1984 281 p refs
(Grant NsG-7172)
(NASA-CR-172328; NAS 1.26:172328) Avail: NTIS HC A13/MF A01 CSCL 01A

Self streamlining two dimensional flexible walled test sections eliminate the uncertainties found in data from conventional test sections particularly at transonic speeds. The test section sidewalls are rigid, while the floor and ceiling are flexible and are positioned to streamline shapes by a system of jacks, without reference to the model. The walls are therefore self streamlining. Data are taken from the model when the walls are good streamlines such that the inevitable residual wall induced interference is acceptably small and correctable. Successful two dimensional validation testing at low speeds has led to the development of a new transonic flexible walled test section. Tunnel setting times are minimized by the development of a rapid wall setting strategy coupled with on line computer control of wall shapes using motorized jacks. Two dimensional validation testing using symmetric and cambered aerofoils in the Mach number range up to about 0.85 where the walls are just supercritical, shows good agreement with reference data using small height-chord ratios between 1.5 and unity. M.A.C.

N84-22535*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

NUMERICAL SIMULATION OF THE TIP VORTEX OFF A LOW-ASPECT-RATIO WING AT TRANSONIC SPEED

N. N. Mansour (Stanford Univ., Calif.) Apr. 1984 36 p refs
(NASA-TM-85932; A-9693; NAS 1.15:85932) Avail: NTIS HC A03/MF A01 CSCL 01A

The viscous transonic flow around a low aspect ratio wing was computed by an implicit, three dimensional, thin-layer Navier-Stokes solver. The grid around the geometry of interest is obtained numerically as a solution to a Dirichlet problem for the cube. A low aspect ratio wing with large sweep, twist, taper, and camber is the chosen geometry. The topology chosen to wrap the mesh around the wing with good tip resolution is a C-O type mesh. The flow around the wing was computed for a free stream Mach number of 0.82 at an angle of attack of 5 deg. At this Mach number, an oblique shock forms on the upper surface of the wing, and a tip vortex and three dimensional flow separation off the wind surface are observed. Particle path lines indicate that the three dimensional flow separation on the wing surface is part of the roots of the tip vortex formation. The lifting of the tip vortex before the wing trailing edge is observed by following the trajectory of particles release around the wing tip. E.A.K.

N84-22536*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

ASSESSMENT OF AERODYNAMIC PERFORMANCE OF V/STOL AND STOVL FIGHTER AIRCRAFT

W. P. Nelms Apr. 1984 38 p refs
(NASA-TM-85937; A-9690; NAS 1.15:85937) Avail: NTIS HC A03/MF A01 CSCL 01A

The aerodynamic performance of V/STOL and STOVL fighter/attack aircraft was assessed. Aerodynamic and propulsion/airframe integration activities are described and small and large scale research programs are considered. Uncertainties affecting aerodynamic performance that are associated with special configuration features resulting from the V/STOL requirement are addressed. Example uncertainties relate to minimum drag, wave drag, high angle of attack characteristics, and power induced effects. E.A.K.

N84-22537*# United Technologies Research Center, East Hartford, Conn.

ALESEP: A COMPUTER PROGRAM FOR THE ANALYSIS OF AIRFOIL LEADING EDGE SEPARATION BUBBLES

R. L. Davis, V. N. Vatsa, and J. E. Carter Apr. 1984 69 p refs (Contract NAS1-16585)
(NASA-CR-172310; NAS 1.26:172310) Avail: NTIS HC A04/MF A01 CSCL 01A

The ALESEP program for the analysis of the inviscid/viscous interaction which occurs due to the presence of a closed laminar transitional separation bubble on an airflow is presented. The ALESEP code provides a iterative solution of the boundary layer equations expressed in an inverse formulation coupled to a Cauchy integral representation of the inviscid flow. This interaction analysis is treated as a local perturbation to a known solution obtained from a global airfoil analysis. Part of the required input to the ALESEP code are the reference displacement thickness and tangential velocity distributions. Special windward differencing may be used in the reversed flow regions of the separation bubble to accurately account for the flow direction in the discretization of the streamwise convection of momentum. The ALESEP code contains a forced transition model based on a streamwise intermittency function and a natural transition model based on a solution of the integral form of the turbulent kinetic energy equation. Instructions for the input/output, and program usage are presented. E.A.K.

N84-22538# Aerospace Corp., El Segundo, Calif. Vehicle Engineering Div.

THREE-DIMENSIONAL, TWO-PHASE SUPERSONIC NOZZLE FLOWS Final Report, Oct. 1980 - Jan. 1982
I. S. Chang 1 Oct. 1983 54 p
(Contract F04701-83-C-0084)
(AD-A138649; TR-0084(9975)-2) Avail: NTIS HC A04/MF A01 CSCL 20/4

Fully coupled two-phase supersonic flows inside three-dimensional nozzles of various configurations are studied, and the behavior of flows with and without solid particles is compared and discussed. The presence of solid particles in the supersonic flow delays gas-phase expansion and alters the imbedded compressive gas-phase shock strength. The results from the present study for an axisymmetric nozzle are compared with those of the well-known SPP code. Isometric projection of three-dimensional contour plots is used for concise interpretation for the computed results of a Mach 3 inlet one- and two-phase flow under various operating conditions. Author (GRA)

N84-22539# George Washington Univ., Washington, D.C. School of Engineering.
ENERGETICS OF VORTEX RING FORMATION Interim Report
J. Z. Irdumsa and C. A. Garris Nov. 1983 7 p
(Contract F49620-80-C-0043; AF Proj. 2307)
(AD-A138795; AFOSR-84-0110TR) Avail: NTIS HC A02/MF A01 CSCL 20/4

This paper presents an experimental investigation comparing the mass and energy content of fully formed laminar vortex rings in air with that of the original pulse which generated them for a variety of initial and boundary conditions. In particular, the fractional entrainment of mass and the partition of initial energy between kinetic energy of translation and kinetic energy of rotation is studied. It is found that a large degree of control can be exercised for the determination of the vortex energetics, as well as its final configuration. A technique is presented which enables calculation of kinetic energy of rotation from movie sequences. The ratio of characteristic translational speed to characteristic rotational speed is shown to be a useful parameter for correlation of data. Data on vortex size and speed are presented using this correlation and it is seen that all data, regardless of initial and boundary conditions, fall on a single curve. A theoretical curve is derived and it is seen that the data compare well with it. Author (GRA)

N84-22540# Notre Dame Univ., Ind. Dept. of Aerospace and Mechanical Engineering.
AN EXPERIMENTAL AND ANALYTIC STUDY OF THE FLOW SUBSONIC WIND TUNNEL INLETS Final Report, Jan. 1981 - Jun. 1983
S. M. Batill, M. J. Caylor, and J. J. Hoffman Wright-Patterson AFB, Ohio AFWAL Oct. 1983 173 p
(Contract F33615-81-K-3008; AF Proj. 2307)
(AD-A138865; AFWAL-TR-83-3109) Avail: NTIS HC A08/MF A01 CSCL 20/4

This report documents an experimental and numerical study of the aerodynamic behavior of three dimensional subsonic wind tunnel inlets. The purpose of the study was to develop a rational procedure for the aerodynamic design of high contraction ratio, subsonic wind tunnel inlets. Of particular concern were those factors associated with the inlet design which would influence the use of smoke flow visualization techniques. This three-phased study included the following tasks: (1) The development and assessment of aerodynamic calculation techniques suitable for subsonic wind tunnel inlet flow-field predictions. Both a surface panel technique and a finite difference field solution were developed, (2) The design and fabrication of an indraft tunnel inlet which could be used to visualize the flow within the inlet, (3) The development of design criteria based on the numerical prediction techniques for three dimensional inlets with contraction ratios in a range of 10-40. Four basic parameters were used to characterize the inlet flow fields and a series of design charts are presented for matched cubic wall geometries. GRA

N84-22541# Sandia Labs., Albuquerque, N. Mex.
PRELIMINARY RESULTS OF THE EFFECTS OF SEWING, PACKING AND PARACHUTE DEPLOYMENT ON MATERIAL STRENGTH
R. H. Ericksen, W. B. Pepper, and L. D. Whinery 1984 8 p refs Presented at the 8th AIAA Aerodyn. Decelerator and Balloon Technol. Conf., Hyannis, Mass., 2 Apr. 1984
(Contract DE-AC04-76DP-00789)
(DE84-006464; SAND-83-1753C; CONF-840496-1) Avail: NTIS HC A02/MF A01

Ribbon parachute fabrics of a 24 ft parachute, and after 2.5 years ambient exposure at several storage sites were tested. The effects of sewing, packing, and parachute deployment on material strength were obtained in the 1000 lb Kevlar ribbon after moisture exposure during packing, and when packed parachutes absorbed moisture or were thermal cycled. Individual yarn samples from the low strength ribbons exhibited little change in strength indicating that the material itself had not degraded. Factors leading to the change in ribbon strength are discussed. Considering all materials, there have been no indications to date of any uncontrollable changes in material strength that would limit the use of Kevlar in parachute applications. DOE

N84-22542 Princeton Univ., N. J.
DATA ACQUISITION AND AERODYNAMIC COEFFICIENT ESTIMATION AT HIGH ANGLES OF ATTACK Ph.D. Thesis
Muthuthamby Sri-Jayantha 1983 238 p
Avail: Univ. Microfilms Order No. DA8402704

Aerodynamic coefficients of a Schweizer 2-32 sailplane are estimated from actual flight test data for angles of attack (alpha) up to 30 deg and sideslip angles (beta) to 17 deg. The comprehensive nonlinear aerodynamic model is identified by applying the Estimation-Before-Modeling (EBM) technique to flight data derived from fifteen maneuvers including stalls and post-stall gyrations. The static, dynamic, and control coefficients and sensitivities that are identified in 50 (alpha, beta) subspaces provide valuable insight into the problems of flight in the stalled regime. Static lift characteristics show gradual loss of lift beyond stall, while drag rises continuously with an increasing gradient. The sideslip angle contributes significantly to the lift coefficient in the post-stall regime, where the maximum lift and the maximum-lift-angle-of-attack increase with the sideslip angle. Pitch rate and elevator inputs contribute considerably to the total lift. A stable nosedown pitching moment is evident; the pitch damping and pitch control derivatives decreases with increasing angle of attack but remain effective into the post-stall regime. Dissert. Abstr.

N84-22543 Virginia Polytechnic Inst. and State Univ., Blacksburg.
THREE-DIMENSIONAL NONEQUILIBRIUM VISCOUS SHOCK-LAYER FLOWS OVER COMPLEX REENTRY VEHICLES Ph.D. Thesis
Subramaniam Swaminathan 1984 118 p
Avail: Univ. Microfilms Order No. DA8402809

A computer program for predicting the three-dimensional nonequilibrium viscous shock-layer flows over blunt sphere-cones, straight and bent multiconics at angle-of-attack has been developed. The method used is the viscous shock-layer approach for nonequilibrium, multi-component ionizing air. A seven species chemical reaction model with single ionizing species and an eleven species chemical reaction model with five ionizing species are used to represent the chemistry. The seven species model considers 7 reactions whereas the eleven species model considers 26, reactions and the results obtained using these models are compared with perfect gas and equilibrium air results. This code is capable of analyzing shock-slip or no-shock-slip boundary conditions and equilibrium or non-catalytic wall boundary conditions. In this study the diffusion model is limited to binary diffusion. A sphere-cone-cylinder-flare with moderate flare angle, a straight biconic, and a bent biconic with seven deg. bend angle and a sphere-cone at various flight conditions are analyzed using this method. Dissert. Abstr.

N84-22544 Virginia Polytechnic Inst. and State Univ., Blacksburg.
EXPERIMENTAL INVESTIGATION OF THE INTERNAL FLOW FIELD IN STOL ENGINE INLETS Ph.D. Thesis

Atul Bahadur Mathur 1983 262 p
Avail: Univ. Microfilms Order No. DA8402801

The internal flow structure in two 2-D inlet models designed for STOL aircraft applications is investigated through wind tunnel testing. The two-dimensional configuration for the models is chosen to facilitate use of flow visualization techniques such as Schlieren and Shadowgraph photography. In the design of such inlets, a major criterion is the avoidance of internal flow separation, particularly the kind that creates an unacceptable total pressure loss in the diffuser as well as severe flow distortion at the fan or compressor face. The main focus of this study is on identifying the various mechanisms that promote or lead to flow separation. An experimental parametric study involving the contraction ratio, the angle of incidence, the throat Mach number (weight flow through the inlet) and the freestream velocity has been carried out in the Virginia Tech 6 ft. x 6 ft. Low Speed Stability Wind Tunnel. Flow separation is delayed in general by an increase in the Contraction Ratio. Dissert. Abstr.

N84-22628# Calspan Advanced Technology Center, Buffalo, N.Y. Dept. of Physical Sciences.
MACH NUMBER AND DENSITY EFFECTS IN THE MIXING OF SUPERSONIC JETS
C. Padova, D. W. Boyer, and W. H. Wurster (Wilson Greatbach Ltd., Buffalo, N.Y.) *In* APL The 14th JANNAF Plume Technol. Meeting, Vol. 1 Nov. 1983 p 107-116 refs (For primary document see N84-22619 13-20)
(Contract F04611-80-C-0011)
Avail: NTIS HC A07/MF A01 CSCL 01A

N84-22686# California Inst. of Tech., Pasadena.
NUMERICAL ANALYSIS OF AN UNSTEADY SHOCK IN AN INLET DIFFUSER
V. Yang and F. E. C. Culick *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 629-634 refs (For primary document see N84-22632 13-20)
(Grant AF-AFOSR-0265-80)
Avail: NTIS HC A99/MF A01 CSCL 01A

N84-22687*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
NUMERICAL PREDICTIONS OF RESIDENCE TIMES BEHIND A REARWARD FACING STEP WITH TRANSVERSE INJECTION
R. Clayton Rogers and Elizabeth H. Weidner *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 635-652 refs (For primary document see N84-22632 13-20)
Avail: NTIS HC A99/MF A01 CSCL 01A

N84-22786# Joint Publications Research Service, Arlington, Va.
MORE PRECISE NUMERICAL SIMULATION OF TRANSSONIC FLOW THROUGH PASSAGES IN TURBOMACHINES Abstract Only
M. D. Krementskiy and R. M. Yablonik *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 11 Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved.: Energetika (Minsk), no. 12, Dec. 1983 p 63-67 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

N84-22790# Joint Publications Research Service, Arlington, Va.
EXACT SOLUTION TO PROBLEM OF INTERACTION BETWEEN WEDGE MOVING AT SUPERSONIC VELOCITY AND INTERFACE OF TWO GASEOUS MEDIA Abstract Only
R. Y. Tugazakov *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 13 Transl. into ENGLISH from Zh. Prikl. Mekhan. Tekhn. Fiz. (Novosibirsk, USSR), no. 5, Sep. - Oct. 1983 p 94-98 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

N84-22791# Joint Publications Research Service, Arlington, Va.
THEORY OF HYPERSONIC THREE-DIMENSIONAL FLOW OF NONSTEADY GAS STREAM WITH RELAXATION PAST THIN WING WITH ARBITRARY ASPECT RATIO Abstract Only
M. M. Kuznetsov *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 14 Transl. into ENGLISH from Zh. Prikl. Mekhan. Tekhn. Fiz. (Novosibirsk, USSR), no. 5, Sep. - Oct. 1983 p 88-93 Previously announced in IAA as A84-21120 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

N84-22792# Joint Publications Research Service, Arlington, Va.
EXCITATION OF TOLLMIN-SCHLICHTING WAVES IN BOUNDARY LAYER AT VIBRATING SURFACE OF INFINITE-SPAN SWEPTBACK WING Abstract Only
A. M. Tumin *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 15 Transl. into ENGLISH from Zh. Prikl. Mekhan. i Tekhn. Fiz. (Novosibirsk, USSR), no. 5, Sep. - Oct. 1983 p 70-74 Previously announced in IAA as A84-21117 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

N84-22794# Joint Publications Research Service, Arlington, Va.
INTERACTION OF UNSTEADY SPATIAL BOUNDARY LAYER WITH HYPERSONIC FLOW NEAR RAPIDLY HEATED PORTION OF SURFACE Abstract Only
A. V. Kazakov *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 16 Transl. into ENGLISH from Izv. Akad. Nauk SSSR: Mekhan. Zhidkosti i Gaza (Moscow), no. 5, May 1983 p 65-72 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

N84-22795# Joint Publications Research Service, Arlington, Va.
HYPERSONIC FLOW AROUND FLAT BODY IN CASE OF INTENSE RADIATIVE HEAT EXCHANGE Abstract Only
I. V. Nemchinov and S. P. Popov *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 17 Transl. into ENGLISH from Izv. Akad. Nauk SSSR: Mekhan. Zhidkosti i Gaza (Moscow), no. 5, May 1983 p 126-129 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

N84-22796# Joint Publications Research Service, Arlington, Va.
TRANSONIC FLOW AROUND PROTRUDING CORNER WITH FREE STREAMLINE Abstract Only
V. N. Diyesperov *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 17-18 Transl. into ENGLISH from Izv. Akad. Nauk SSSR: Mekhan. Zhidkosti Gaza (Moscow), no. 5, May 1983 p 130-137 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

N84-22797# Joint Publications Research Service, Arlington, Va.
WAVE DRAG OF ELONGATED ASTROID BODIES AT MODERATE SUPERSONIC FLIGHT VELOCITIES Abstract Only
M. I. Folle *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 18 Transl. into ENGLISH from Izv. Akad. Nauk SSSR: Mekhan. Zhidkosti i Gaza (Moscow), no. 5, May 1983 p 146-151 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N84-22545# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
A GENERALIZED ESCAPE SYSTEM SIMULATION (GESS) COMPUTER PROGRAM: GESS USER'S GUIDE, VERSION 2, VOLUME 1 Final Report
L. A. DAulerio and D. A. Fender Sep. 1983 178 p

(W1100)
(AD-A138844; NADC-83111-60) Avail: NTIS HC A09/MF A01 CSCL 01/3

The Generalized Escape System Simulation (GESS) program is a computerized mathematical model for dynamically simulating the performance of existing or developmental aircraft ejection seat systems. The program generates six-dimensional trajectory predictions of the aircraft, seat/occupant, occupant alone, and seat alone by calculating the forces and moments imposed on these elements by the seat catapults, rails, rockets, stabilization, and recovery systems included in most escape system configurations. User options are provided to simulate the performance of all conventional escape system designs under most environmental conditions and aircraft attitudes or trajectories. This GESS User's Guide describes the elements and events occurring in typical escape systems, the theory and formulation of the simulation model, and the procedures necessary to successfully prepare, execute, and utilize this and the related ACT and DRAS programs. The GESS Programmer's Manual, a companion guide, lists the annotated FORTRAN-IV program code, and represents the second of two volumes of GESS documentation. Author (GRA)

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications.*

N84-22546* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NAVIGATION SYSTEM AND METHOD Patent
Ralph E. Taylor (Howard Univ., Washington, D.C.) and James W. Sennott, inventors (to NASA) (Howard Univ., Washington, D.C.) Issued 24 Apr. 1984 20 p Filed 22 May 1981 Sponsored by NASA
(NASA-Case-GSC-12508-1; US-Patent-4,445,118; US-Patent-Appl-SN-266253; US-Patent-Class-343-357; US-Patent-Class-343-356) Avail: US Patent and Trademark Office CSCL 17G

In a global positioning system (GPS), such as the NAVSTAR/GPS system, wherein the position coordinates of user terminals are obtained by processing multiple signals transmitted by a constellation of orbiting satellites, an acquisition-aiding signal generated by an earth-based control station is relayed to user terminals via a geostationary satellite to simplify user equipment. The aiding signal is FSK modulated on a reference channel slightly offset from the standard GPS channel. The aiding signal identifies satellites in view having best geometry and includes Doppler prediction data as well as GPS satellite coordinates and identification data associated with user terminals within an area being served by the control station and relay satellite. The aiding signal significantly reduces user equipment by simplifying spread spectrum signal demodulation and reducing data processing functions previously carried out at the user terminals.
Official Gazette of the U.S. Patent and Trademark Office

N84-22547# Defence Research Establishment, Ottawa. (Ontario).
PERFORMANCE EVALUATION OF A MAGNAVOX GPS (GLOBAL POSITIONING SYSTEM) Z-SET
M. F. Vinnins Apr. 1983 26 p
(AD-A138569; DREO-TN-83-3) Avail: NTIS HC A03/MF A01 CSCL 17/7

A Magnavox Global Positioning System (GPS) Z-Set Receiver was obtained on loan from the United States NAVSTAR/GPS Joint Program Office for evaluation. Tests were carried out in an electronically-equipped trailer, on-board a naval research vessel and in a Twin Otter flying laboratory. Data was manually recorded during static positioning tests and waypoint navigation tests. Results indicated a static positioning accuracy consistantly better than 100 feet in both latitude and longitude under 4-satellite availability. Author (GRA)

N84-22548# Mitre Corp., McLean, Va. Metrek Div.
SYSTEM SAFETY STUDY OF MINIMUM TCAS II (TRAFFIC ALERT AND COLLISION AVOIDANCE SYSTEM) Final Report
J. E. Lebron, A. D. Zeitlin, N. A. Spencer, J. W. Andrews, and W. H. Harman Dec. 1983 366 p
(Contract DTFA01-84-C-0001)
(AD-A138674; MTR-83W241; DOT/FAA/PM-83/36) Avail: NTIS HC A16/MF A01 CSCL 01/2

A System Safety study was conducted to assess the overall safety characteristics associated with use of the airborne collision avoidance system called minimum TCAS II (Traffic Alert and Collision Avoidance System). The limitations imposed by incomplete transponder equipage, altimetry instrumentation errors, and suddenly maneuvering intruders were quantified. Other failure mechanisms, including those related to human factors, were also assessed. The role of visual acquisition and a quantitative evaluation of it was explored. The impact on system safety caused by the failure modes and their interrelations was evaluated by means of a fault free analysis. Author (GRA)

N84-22549# Federal Aviation Administration, Washington, D.C. Office of Aviation Policy and Plans.
FAA (FEDERAL AVIATION ADMINISTRATION) AVIATION FORECASTS -FISCAL YEARS 1984-1995
M. Olson, G. Mercer, R. Bowles, C. Moles, and A. Schwartz Feb. 1984 81 p
(AD-A138759; FAA-APO-84-1) Avail: NTIS HC A05/MF A01 CSCL 01/2

This report contains the Fiscal Years 1984-1995 Federal Aviation Administration (FAA) forecasts of aviation activity at FAA facilities. These include airports with FAA control towers, air route traffic control centers, and flight service stations. Detailed forecasts were made for the four major users of the national aviation system: air carriers, air taxi/commuters, general aviation and the military. The forecasts have been prepared to meet the budget and planning needs of the constituent units of the FAA and to provide information that can be used by state and local authorities, by the aviation industry and the general public. The overall outlook for the forecast period is for strong economic growth relatively stable real fuel prices, and moderate inflation. Based upon these assumptions, aviation activity is forecast to increase by Fiscal Year 1995 by 79 percent at towered airports (commuters, 73 percent; air carrier, 23 percent; general aviation, 101 percent; military, 0 percent), 45 percent at air route traffic control centers (commuters, 110 percent; air carriers, 25 percent; general aviation, 74 percent; military, 0 percent), and 60 percent in flight services performed. Hours flown by general aviation is forecast to increase 60 percent and helicopter hours 67 percent. Scheduled domestic revenue passenger miles (RPM's) are forecast to increase 81 percent, with scheduled international RPM's forecast to increase by 79 percent and commuter RPM's forecast to increase by 195 percent. GRA

N84-22550# Kaiser Electronics, San Jose, Calif.
EN ROUTE/TERMINAL ATC (AIR TRAFFIC CONTROL) OPERATIONS CONCEPT Final Report
H. Ammerman, C. Fligg, Jr., W. Pieser, G. Jones, and K. Tischer 28 Oct. 1983 435 p
(Contract DTFA01-83-Y-10554)
(AD-A138991; FAA-AP-83-16) Avail: NTIS HC A19/MF A01 CSCL 17/7

This document captures in one place the information processing tasks of the en route and terminal controller. This will serve to aid the engineer and designer to the future Advanced Automation System (AAS) with some insight into the why, what and how of current Air Traffic Control operations. The AAS will see the integration and consolidation of terminal and en route processes into what is termed the Area Control Facility (ACF). This document

takes an operational view of the current systems and presents data on how the controller does his perceptual, cognitive and motor functions. The analysis approach is to treat the controller as a human information processor who interacts with a variety of ATC systems to perform the tasks of expediting, separating, and controlling air traffic. Specific methods and techniques are employed to rigorously identify and characterize these functions, or information processing/handling tasks. From this, one can infer, study, analyze and eventually develop in the AAS the capabilities for aiding and improving controller productivity. In addition, this document preserves, for the purposes of transition to the ACF, the design information that is applicable to the activities on a controller. These are the set of activities and information processing tasks performed at the Radar Positions in terminal approach control and en route centers. The focus of this document is on the composition and analysis of controller tasks, and not on the machine functions described in NAS Stage A3d2 and ARTS II, III Technical documentation. GRA

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.*

N84-22551* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SLOTTED VARIABLE CAMBER FLAP Patent
Dana G. Andrews, inventor (to NASA) (Boeing Commercial Airplane Co., Seattle) Issued 24 Apr. 1984 8 p Filed 30 Oct. 1981 Sponsored by NASA
(NASA-Case-LAR-12541-1; US-Patent-4,444,368; US-Patent-Appl-SN-315588; US-Patent-Class-244-216; US-Patent-Class-244-215; US-Patent-Class-244-219; US-Patent-Class-244-212) Avail: US Patent and Trademark Office CSCL 01C

Variable camber actuator assemblies broaden the range of speeds at which lift to drag performance is maximized for slotted flap wings. Lift is improved over a broader range of cruising speeds by varying wing camber with rotational flap movements that do not introduce wing slots and induced drag. Forward flaps are secured to forward flange links which extended from, and are a part of forward flap linkage assemblies. The forward flaps rotate about flap pivots with their rotational displacement controlled by variable camber actuator assemblies located between the forward flaps and the forward flange links. Rear flaps are held relative to the forward flaps by rear flap linkage assemblies which may act independently from the forward flap linkage assemblies and the variable camber actuator assemblies. Wing camber is varied by rotating the flaps with the variable camber actuator assemblies while the flaps are in a deployed or tucked position. Rotating the flaps in a tucked position does not introduce significant wing surface discontinuities, and reduces aircraft fuel consumption on most flight profiles. Official Gazette of the U.S. Patent and Trademark Office

N84-22552 North Carolina State Univ., Raleigh.
MODEL IDENTIFICATION AND PARAMETER ESTIMATION OF THE POWER, LIFT, AND DRAG OF LIGHT AIRCRAFT FROM A SINGLE MANEUVER Ph.D. Thesis
Baruch Ephraim Karlin 1983 195 p
Avail: Univ. Microfilms Order No. DA8402105

The development and implementation of a procedure to extract power, drag, and lift from a single dynamic aircraft maneuver is presented. The procedure was tested for simulated and real data. Difficulties due to ill-conditioning, noise, and data incompatibility required incorporating in the procedures algorithms to identify and deal with these problems. The simulated data was corrupted with errors, showing that the procedure can handle data with noise and inconsistencies. The experimental dataset exhibited some distinct extraneous signals. Some of these signals cannot be removed from the dataset, and since they are not part of the aircraft dynamics, they distort the process to the point where elaborate models cannot be identified. The procedure gives good results for simplified models. Dissert. Abstr.

N84-22553*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
DEVELOPMENT AND ANALYSIS OF A STOL SUPERSONIC CRUISE FIGHTER CONCEPT
S. M. Dollyhigh, W. E. Foss, Jr., S. J. Morris, Jr., K. B. Walkley (Kentron International, Inc., Hampton, Va.), E. E. Swanson (Kentron International, Inc., Hampton, Va.), and A. W. Robins (Kentron International, Inc., Hampton, Va.) Mar. 1984 86 p ref
(NASA-TM-85777; NAS 1.15:85777) Avail: NTIS HC A05/MF A01 CSCL 01C

The application of advanced and emerging technologies to a fighter aircraft concept is described. The twin-boom fighter (TBF-1) relies on a two dimensional vectoring/reversing nozzle to provide STOL performance while also achieving efficient long range supersonic cruise. A key feature is that the propulsion package is placed so that the nozzle hinge line is near the aircraft center-of-gravity to allow large vector angles and, thus, provide large values of direct lift while minimizing the moments to be trimmed. The configurations name is derived from the long twin booms extending aft of the engine to the twin vertical tails which have a single horizontal tail mounted atop and between them. Technologies utilized were an advanced engine (1985 state-of-the-art), superplastic formed/diffusion bonded titanium structure, advanced controls/avionics/displays, supersonic wing design, and conformal weapons carriage. The integration of advanced technologies into this concept indicate that large gains in takeoff and landing performance, maneuver, acceleration, supersonic cruise speed, and range can be acieved relative to current fighter concepts. Author

N84-22554# Texas Univ., Austin. Austin Dept. of Mechanical Engineering.
QUANTIFICATION OF SUBJECTIVE RATINGS THROUGH CONJOINT MEASUREMENT ANALYSIS Final Report
D. E. Greene 8 Nov. 1983 39 p
(Grant AF-AFOSR-0220-82; AF Proj. 2313)
(AD-A138810; AFOSR-84-0126TR) Avail: NTIS HC A03/MF A01 CSCL 01/2

Conjoint measurement theory is examined through a prototype example in which a fighter aircraft is subjectively rated on two factors. As a first step, a multifactor ordinal scale is developed. This ordinal scale provides a meaningful measure of aircraft quality. Interval scales of aircraft quality are produced by the basic analysis of variance model and two conjoint measurement methods: delta scaling and the computer algorithm MONANOVA. These methods produce interval scales that differ by constant factors, as guaranteed by the theorem for additive conjoint measurement. The interval scale does not appear to be an improvement over the ordinal scale in the prototype example. There is no assurance that a specific conjoint measurement model can be used to improve the data. Major changes in the interval scales are caused by small perturbations in the rating matrix. Author (GRA)

N84-22555# Dayton Univ., Ohio. Research Inst.
A REVIEW STUDY OF NONDESTRUCTIVE TEST TECHNIQUES FOR RESIDUAL STRESSES IN AIRCRAFT TRANSPARENCIES Final Technical Report, Jun. - Dec. 1982
B. B. Raju Wright-Patterson AFB, Ohio AFWAL Jan. 1984 88 p
(Contract F33615-80-C-3401; AF Proj. 1926)
(AD-A138930; UDR-TR-83-70; AFWAL-TR-83-3108) Avail: NTIS HC A05/MF A01 CSCL 14/2

The main objectives of this program are to conduct review studies on candidate nondestructive test techniques for determining residual stresses in aircraft transparencies; identify and recommend nondestructive test techniques having potential for further laboratory development and field use. The program consisted of three primary tasks: a comprehensive general literature review of over 150 publications on holography, X-rays, moire', scattered-light,

thermal methods, ultrasonic techniques, acoustic emission, magneto-photoelasticity, integrated photoelasticity, laser diffraction, and eddy current techniques; a detailed literature review on scattered light photoelasticity, ultrasonic technique 1 based on the Rayleigh surface waves, ultrasonic technique 2 based on the ultrasonic energy reflection at a liquid-solid interface magneto-photoelasticity, and laser diffraction; detailed review studies on scattered-light techniques and ultrasonic techniques 1 and 2. The studies revealed that the basic principles and experimental procedure of ultrasonic technique 1 based on Rayleigh surface waves is fairly well developed. GRA

N84-22556# Naval Postgraduate School, Monterey, Calif.
EDUCATIONAL AIDS IN AIRCRAFT COMBAT SURVIVABILITY M.S. Thesis
P. G. Cox Dec. 1983 156 p
(AD-A139090) Avail: NTIS HC A08/MF A01 CSCL 05/9

This thesis presents four additions prepared for the textbook 'The Fundamentals of Aircraft Combat Survivability Analysis and Design' by Professor Robert E. Ball. A set of homework problems with solutions was developed for the textbook to provide the user with a means of measuring student progress. An index, a lexicon of terminology, and a formulary were also developed to enhance the usability of the textbook. GRA

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography.*

N84-22557*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PRELIMINARY EXPERIENCE WITH A STEREOSCOPIC VIDEO SYSTEM IN A REMOTELY PILOTED AIRCRAFT APPLICATION
Terrence W. Rezek Sep. 1983 14 p refs Prepared in cooperation with NASA/Dryden Flight Research Facility, Edwards, Calif.
(NASA-TM-84909; H-1185; NAS 1.15:84909) Avail: NTIS HC A02/MF A01 CSCL 01D

Remote piloting video display development at the Dryden Flight Research Facility of NASA's Ames Research Center is summarized, and the reasons for considering stereo television are presented. Pertinent equipment is described. Limited flight experience is also discussed, along with recommendations for further study. Author

N84-22558*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
FREQUENCY ENCODED AUDITORY DISPLAY OF THE CRITICAL TRACKING TASK
James Stevenson Apr. 1984 18 p refs
(NASA-TM-85869; A-9576; NAS 1.15:85869) Avail: NTIS HC A02/MF A01 CSCL 01D

The use of auditory displays for selected cockpit instruments was examined. In auditory, visual, and combined auditory-visual compensatory displays of a vertical axis, critical tracking task were studied. The visual display encoded vertical error as the position of a dot on a 17.78 cm, center marked CRT. The auditory display encoded vertical error as log frequency with a six octave range; the center point at 1 kHz was marked by a 20-dB amplitude notch, one-third octave wide. Asymptotic performance on the critical tracking task was significantly better when using combined displays rather than the visual only mode. At asymptote, the combined display was slightly, but significantly, better than the visual only mode. The maximum controllable bandwidth using the auditory mode was only 60% of the maximum controllable bandwidth using the visual mode. Redundant cueing increased the rate of improvement of tracking performance, and the asymptotic performance level. This enhancement increases with the amount of redundant cueing used. This effect appears most prominent when the bandwidth of the forcing function is substantially less than the upper limit of controllability frequency. E.A.K.

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N84-22559* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
REAL TIME PRESSURE SIGNAL SYSTEM FOR A ROTARY ENGINE Patent
William J. Rice, inventor (to NASA) Issued 31 Jan. 1984 11 p Filed 19 Feb. 1982
(NASA-Case-LEW-13622-1; US-Patent-4,428,226; US-Patent-Appl-SN-350473; US-Patent-Class-73-115; US-Patent-Class-364-558) Avail: US Patent and Trademark Office CSCL 21A

A real-time IMEP signal which is a composite of those produced in any one chamber of a three-lobed rotary engine is developed by processing the signals of four transducers positioned in a Wankel engine housing such that the rotor overlaps two of the transducers for a brief period during each cycle. During the overlap period of any two transducers, their output is compared and sampled for 10 microseconds per 0.18 degree of rotation by a sampling switch and capacitive circuit. When the switch is closed, the instantaneous difference between the value of the transducer signals is provided while with the switch open the average difference is produced. This combined signal, along with the original signal of the second transducer, is fed through a multiplexer to a pressure output terminal. Timing circuits, controlled by a crank angle encoder on the engine, determine which compared transducer signals are applied to the output terminal and when, as well as the open and closed periods of the switches.
Official Gazette of the U.S. Patent and Trademark Office

N84-22560* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TIP CAP FOR A ROTOR BLADE
William K. Kofel (GE, Cincinnati), Eugene N. Tuley (GE, Cincinnati), Charles H. Gay, Jr. (GE, Cincinnati), Raymond E. Troeger (GE, Cincinnati), and Albert P. Sterman, inventors (to NASA) (GE, Cincinnati) 25 Oct. 1983 7 p Filed 20 Mar. 1981 Sponsored by NASA
(NASA-Case-LEW-13654-1; US-Patent-4,411,597; US-Patent-Appl-SN-245571; US-Patent-Class-416-92; US-Patent-Class-416-97R; US-Patent-Class-416-224; US-Patent-Class-416-233) Avail: US Patent and Trademark Office CSCL 21E

A replaceable tip cap for attachment to the end of a rotor blade is described. The tip cap includes a plurality of walls defining a compartment which, if desired, can be divided into a plurality of subcompartments. The tip cap can include inlet and outlet holes in walls thereof to permit fluid communication of a cooling fluid there through. Abrasive material can be attached with the radially outer wall of the tip cap.
Official Gazette of the U.S. Patent and Trademark Office

N84-22561# Aircraft Research Association Ltd., Bedford (England).
CIVIL TURBOFAN PROPULSION SYSTEM INTEGRATION STUDIES USING POWERED TESTING TECHNIQUES AT ARA, BEDFORD
A. E. Harris and K. C. Paliwal Mar. 1984 26 p refs
(ARA-Memo-246) Avail: NTIS HC A03/MF A01

Details are given of powered testing techniques used in civil

turbofan integration studies. Tests and rigs for the study of isolated nacelle inlet and afterbody/nozzle components, isolated complete nacelle/pylon, and installed nacelle/pylon performance are described. The techniques described have placed considerable emphasis on the need to identify the many complex aerodynamic interferences involved. The main theme relates to the use of turbine powered simulator (TPS) nacelles used on both full-span and half-span models for determination of nacelle/pylon installation and interference drag levels. A detailed description of a new Mach Simulation Tank for high accuracy TPS nacelle calibrations is included. B.W.

N84-22562*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DUAL CLEARANCE SQUEEZE FILM DAMPER Patent Application
David P. Fleming, inventor (to NASA) Filed 5 Apr. 1984 13 p (NASA-Case-LEW-13506-1; US-Patent-Appl-SN-596960) Avail: NTIS HC A02/MF A01 CSCL 21E

A dual clearance hydrodynamic liquid squeeze film damper for a gas turbine engine is presented. Under normal operating conditions the device functions as a conventional squeeze film damper, using only one of its oil films. When an unbalance reaches abusive levels, as may occur with a blade loss or foreign object damage, a second, larger clearance film becomes active, controlling vibration amplitudes in a near optimum manner until the engine can be safety shut down and repaired. NASA

N84-22563*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OXIDIZING SEAL FOR A TURBINE TIP GAS PATH Patent Application
James D. Cawley, inventor (to NASA) Filed 19 Apr. 1984 12 p (NASA-Case-LEW-14053-1; US-Patent-Appl-SN-602050) Avail: NTIS HC A02/MF A01 CSCL 21E

The sealing of the gas path in a gas turbine engine at the blade tips is improved by maintaining a minimum clearance between the rotor blade tips and the gas path seal. This is accomplished by taking advantage of an increase in volume during controlled oxidation of certain intermetallic compounds which have high melting points. The increase in volume closes the clearance subsequent to a rub between the blades and the seal. Thus, these compounds re-form the tip seal surface to assure continued engine efficiency. NASA

N84-22564*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPARISON BETWEEN MEASURED TURBINE STAGE PERFORMANCE AND THE PREDICTED PERFORMANCE USING QUASI-3D FLOW AND BOUNDARY LAYER ANALYSES
Robert J. Boyle, Jeffrey E. Haas, and Theodore Katsanis 1984 27 p refs Proposed for presentation at the 20th Joint Propulsion Conf., Cincinnati, 11-13 Jun. 1984; sponsored by AIAA, SAE and ASME
(NASA-TM-83640; E-2065; NAS 1.15:83640; AVRADCOM-TR-84-C-6) Avail: NTIS HC A03/MF A01 CSCL 21E

A method for calculating turbine stage performance is described. The usefulness of the method is demonstrated by comparing measured and predicted efficiencies for nine different stages. Comparisons are made over a range of turbine pressure ratios and rotor speeds. A quasi-3D flow analysis is used to account for complex passage geometries. Boundary layer analyses are done to account for losses due to friction. Empirical loss models are used to account for incidence, secondary flow, disc windage, and clearance losses. Author

N84-22565*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRELIMINARY INVESTIGATION OF A TWO-ZONE SWIRL FLOW COMBUSTOR
James A. Biaglow, Susan M. Johnson, and John M. Smith 1984 20 p refs Proposed for presentation at the 20th Joint Propulsion Conf., Cincinnati, 11-13 Jun. 1984; sponsored by AIAA, SAE, and ASME
(NASA-TM-83637; E-2029; NAS 1.15:83637) Avail: NTIS HC A02/MF A01 CSCL 21E

The effect of full-annular swirling-flow on a flow-zone combustor design is investigated. Swirl flow angles of 25, 35, and 45 degrees were investigated in a combustor design envelope typical of those used in modern engines. The two-zone combustor had 24 pilot-zone fuel injectors and 24 main-fuel injectors located in the centerbody between the pilot and swirl passage. Combustor performance was determined at idle, and two parametric 589 K inlet temperature conditions. Combustor performance was highest with the 45 degree swirl vane design; at the idle condition, combustion efficiency was 99.5 percent. The 45 degree swirl vane also produced the lowest pattern factor of the three angles and showed a combustor lean blowout limit below a 0.001 fuel-air ratio. Combustor total pressure drop varied from a low of 4.6 percent for the 25 degree swirl to a high of 4.9 percent for the 45 degree swirl. M.A.C.

N84-22566*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DETERMINATION OF COMPRESSOR IN-STALL CHARACTERISTICS FROM ENGINE SURGE TRANSIENTS
Carl F. Lorenzo, Francis P. Chiaramonte, and Charles M. Mehalic 1984 27 p refs Proposed for presentation at the 20th Joint Propulsion Conf., 11-13 Jun. 1983; sponsored by the AIAA, SAE and ASME
(NASA-TM-83639; E-2082; NAS 1.15:83639) Avail: NTIS HC A03/MF A01 CSCL 21E

A technique for extracting the in-stall pumping characteristics for an axial flow compressor operating in an engine system environment is developed. The technique utilizes a Hybrid computer simulation of the compressor momentum equation into which actual transient data are used to provide all terms but the desired compressor characteristic. The compressor force characteristic as a function of corrected flow and speed result from the computation. The critical problem of data filtering is addressed. Results for a compressor operating in a turbofan engine are presented and comparison is made with the conventional compressor map. The relationship of the compressor surge characteristic with its rotating stall characteristic is explored. Initial interpretation of the measured results is presented. Author

N84-22567*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EXPERIMENTAL INVESTIGATION OF THE LOW NO/SUB X VORTEX AIRBLAST ANNULAR COMBUSTOR
S. M. Johnson, J. A. Biaglow, and J. M. Smith 1984 14 p refs Presented at the 20th Joint Propulsion Conf., Cincinnati, 11-13 Jun. 1984
(NASA-TM-83615; E-2046; NAS 1.15:83615) Avail: NTIS HC A02/MF A01 CSCL 21E

A low oxides of nitrogen vortex airblast annular combustor was evaluated which has attained the goal of 1 gm NO2/kg fuel or less during operation. The experimental combustor test conditions were a nominal inlet-air temperature of 703 K, inlet total pressures between 0.52 to 0.83 MPa, and a constant inlet Mach number of 0.26. Exit temperature pattern factors for all test points were between 0.16 and 0.20 and exit swirl flow angles were 47 degrees at isothermal conditions and 23 degrees during combustion. Oxides of nitrogen did not exceed 1.05 gm NO2/kg fuel at the highest inlet pressure and exhaust temperature tested. Previous correlations have related NOx proportionally to the combustor inlet pressure raised to some exponent. In this experiment, a band of exponents between 0.5 and 1.0 resulted for fuel-air ratios from 0.023 to 0.027 and inlet pressures from 0.52 to 0.83 MPa. S.L.

N84-22568*# Teledyne CAE, Toledo, Ohio.
VARIABLE STATOR RADIAL TURBINE Final Report
C. Rogo, T. Hajek, and A. G. Chen May 1984 302 p refs
(Contract NAS3-23163; DA Proj. 1L1-61102-AH-45)
(NASA-CR-174663; NAS 1.26:174663; Teledyne-CAE-1987) Avail:

NTIS HC A14/MF A01 CSCL 21E

A radial turbine stage with a variable area nozzle was investigated. A high work capacity turbine design with a known high performance base was modified to accept a fixed vane stagger angle moveable sidewall nozzle. The nozzle area was varied by moving the forward and rearward sidewalls. Diffusing and accelerating rotor inlet ramps were evaluated in combinations with hub and shroud rotor exit rings. Performance of contoured sidewalls and the location of the sidewall split line with respect to the rotor inlet was compared to the baseline. Performance and rotor exit survey data are presented for 31 different geometries. Detail survey data at the nozzle exit are given in contour plot format for five configurations. A data base is provided for a variable geometry concept that is a viable alternative to the more common pivoted vane variable geometry radial turbine. E.A.K.

N84-22569# Minnesota Univ., Minneapolis. Dept. of Mechanical Engineering.

FILM COOLING ON A GAS TURBINE BLADE NEAR THE END WALL Interim Report

R. J. Goldstein and H. P. Chen May 1983 10 p

(Contract F49620-83-C-0062; AF Proj. 2307)

(AD-A138794; AFOSR-84-0109TR) Avail: NTIS HC A02/MF A01 CSCL 21/5

Local film cooling effectiveness on a gas turbine blade with a row of discrete cooling jets was measured using a mass transfer technique. Emphasis is placed on phenomena near the end wall of the blade. This region contains a horseshoe vortex system modified by a passage vortex. On the concave (pressure) surface the film cooling performance is not greatly altered by the presence of the end wall. On the convex surface of the blade the film cooling is essentially absent in a triangular region extending from near the region of peak curvature on the blade to its trailing edge. This unprotected region closely corresponds to location of the passage vortex as indicated by flow visualization. The passage vortex sweeps away the injected coolant flow from the surface. Upstream of the unprotected area the injected flow is skewed toward the middle span of the blade. End wall influence extends about one-half cord length up from the end wall in the present experiments. GRA

N84-22570# Rolls-Royce Ltd., Derby (England).

ENGINE RELIABILITY THROUGH BEARING CONDITION MONITORING

P. A. Mucklow 19 Apr. 1983 9 p Presented at South African Airways Symp. on Engine Monitoring, 19-21 Apr. 1983

(PNR-90168; Reprint-871) Avail: NTIS HC A02/MF A01

The use of magnetic chip detectors to detect bearing fatigue deterioration in RB 211 aircraft engines is described. A detector is located in each of five oil scavenge lines, with a sixth detector in the combined scavenge line. Inspection using magnetic detectors gives an increase from 25 % to 75 % of location of bearing failures, with almost no in-flight shutdown. Author (ESA)

N84-22571# Rolls-Royce Ltd., Derby (England).

ACOUSTIC EMISSION: A BRIEF INTRODUCTION TO SOME OF ITS USES IN THE AERO ENGINE INDUSTRY

T. J. Holroyd 1 Oct. 1983 14 p refs

(PNR-90172; Reprint-875) Avail: NTIS HC A02/MF A01

Acoustic emission (AE) processes which involve the cooperation of aircraft engine material in an irreversable manner, such as crack extension, plastic deformation and phase transformations; and processes which result in no permanent material change but are associated with rapid localized elastic events such as particle impacts, fretting, cavitation and turbulence are discussed. The use of AE for single cycle tests, fatigue tests, honeycomb integrity assessment, monitoring machining processes, and bearing monitoring is described. Author (ESA)

N84-22572# Rolls-Royce Ltd., Derby (England). Advanced Research Lab.

OPTICAL GAS TEMPERATURE MEASUREMENT IN GAS TURBINES

J. D. Black 16 Jun. 1983 13 p refs

(PNR-90174; Reprint-877) Avail: NTIS HC A02/MF A01

The requirements for temperature measurements in the various sections of a gas turbine are discussed. Nonintrusive optical measurement techniques are outlined and their applicability to the engine is discussed. Absorption, incoherent scattering, and Raman techniques are described. Because of the requirement for optical access, gas temperature measurements are more likely to be applied on component test rigs rather than full scale engines, and those measurements which are made on engines are in the exhaust section. Author (ESA)

N84-22573# Rolls-Royce Ltd., Derby (England).

EMISSIONS VARIABILITY AND TRAVERSING ON PRODUCTION RB211 ENGINES

J. K. Bhangu, H. L. Hawkins, C. H. Pridden, and P. H. Walker 1 Oct. 1983 9 p refs Sponsored by FAA

(PNR-90176; Reprint-879) Avail: NTIS HC A02/MF A01

Emissions of RB211 production engines were surveyed in order to determine engine-to-engine variability, and demonstrate that a specific probe design provides a representative sample. Emissions characteristics of six production RB211-524B-02 engines were measured using a fixed cruciform rake to give engine to engine variability in terms of standard deviation/mean for each pollutant. A rotatable cruciform rake was used to traverse the exhaust plane of another RB211-524B4-02 engine for various emissions and total pressure at three power settings. The effects of rake design and positioning, and variations between meaned and individual sample collection methods were evaluated. Results confirm the utility of the method. Emissions legislation is considered. Author (ESA)

N84-22574# Rolls-Royce Ltd., Derby (England).

ENGINE AFFORDABILITY

R. M. Heathcote 1 Jun. 1983 25 p Presented at Royal Aeron. Soc. Management Studies Group Colloq. on Who Can Afford Aerospace Products, Jun. 1983

(PNR-90178; MISC-804) Avail: NTIS HC A02/MF A01

Factors which effect the cost of developing and operating aircraft engines, particularly of civil aircraft, are discussed. Fuel efficiency, reliability, maintenance, weight reduction, safety, and specifications are considered. Author (ESA)

N84-22575# Rolls-Royce Ltd., Derby (England).

THE DEVELOPMENT OF ADVANCED SPECIMEN TESTING AND ANALYSIS TECHNIQUES APPLIED TO FRACTURE MECHANICS LIFING OF GAS TURBINE COMPONENTS

A. C. Pickard, C. W. Brown, and M. A. Hicks 1983 7 p refs

(PNR-90179; Reprint-892) Avail: NTIS HC A02/MF A01

Fracture mechanics analyses of the fatigue lives of components were derived from a corner cracked specimen geometry which closely simulates the cracks observed in rig tested gas turbine components. Using the results, good agreement is obtained between fracture mechanics predictions and observed behavior of rig tested nickel and titanium alloy components containing fatigue induced or artificially generated cracks. However, results show that caution must be exercised in the application of long crack data to situations where the crack size is of the order of or less than the microstructural unit size. Author (ESA)

N84-22576# Rolls-Royce Ltd., Derby (England).

TURBOPROP ENGINE DESIGN CONCEPTS

H. W. Bennett Jun. 1983 8 p

(PNR-90181; Reprint-894) Avail: NTIS HC A02/MF A01

Three major categories of aircraft for the future application of turboprop engines are identified: 30 to 70 seat commuter, cruise speed 250 to 300 kts, design range 600 to 700 nm; 70 to 100 seat super commuter, cruise speed up to 0.7 MN, design range up to 1000 nm; and 100 to 150 seat mainliner, cruise speed 0.7 to 0.8 MN, design range 1000 to 2000 nm. Commercial market potential is discussed. Engine configurations, covering power requirements over the range of 2000 SHP to 12000 SHP are reviewed. Integration and tailoring of the total power plant with

the airframe is seen to be a necessity for the ultimate success in this class of turboprop aircraft. Problems encountered in high power gearbox design and engine concepts are reviewed. Author (ESA)

N84-22577# Rolls-Royce Ltd., Derby (England).
THE ACCELERATING PACE OF ADVANCING AERO ENGINE TECHNOLOGY
J. F. Coplin 5 May 1983 92 p In ENGLISH and GERMAN Presented at 8th European Pioneer's Day, Bonn, 5 May 1983 Sponsored by Procurement Executive of Ministry of Defence
(PNR-90191; Reprint-891) Avail: NTIS HC A05/MF A01

Improvements in jet engine fuel efficiency are discussed. Fan aerodynamics; multistage compressors; high, intermediate and low pressure turbines; advanced turbine materials; and propeller design are discussed. Author (ESA)

N84-22578# Rolls-Royce Ltd., Derby (England).
HELICOPTER ENGINE TECHNOLOGY WITH PARTICULAR REFERENCE TO THE ROLLS-ROYCE GEM ENGINE
D. Lewis Mar. 1981 10 p Presented at Brit. Aviation Seminar and Exhibition 1981, Delhi, 17-19 Mar. 1981 and Bangalore, India, 25-27 Mar. 1981
(PNR-90193; Reprint-751) Avail: NTIS HC A02/MF A01

The Gem gas turbine helicopter engine structure power ratings, control systems, intake protection and surge free handling are discussed. Sensitivity to intake pressure disturbances, and the ability to accept contaminated air in the intake are considered. Author (ESA)

N84-22579# Rolls-Royce Ltd., Derby (England).
SOME THEMES ON ROLLS-ROYCE MILITARY ENGINE TECHNOLOGY. PART 1: OLD AND NEW ENGINES FOR COMBAT AIRCRAFT. PART 2: AFTER-BURNING TECHNOLOGY
P. H. Young Mar. 1981 12 p refs Presented at Brit. Aviation Seminar and Exhibition 1981, Delhi, 17-19 Mar. 1981 and Bangalore, 25-27 Mar. 1981
(PNR-90195; Reprint-919) Avail: NTIS HC A02/MF A01

Engine specifications for a light combat aircraft (LCA) are discussed. Interactions between power plant characteristics and LCA size and capability are considered. The effect of bypass ratio on afterburning technology; reheat design rules; combustion instabilities; jet pipe cooling; control problems; and plenum chamber burning are treated. Author (ESA)

N84-22580# Rolls-Royce Ltd., Derby (England).
FUEL EFFICIENT ENGINES FOR LARGE TRANSPORT
A. G. Newton Mar. 1981 14 p Presented at Brit. Aviation Seminar and Exhibition 1981, Delhi, 17-19 Mar. 1981 and Bangalore, 25-27 Mar. 1981
(PNR-90196; Reprint-913) Avail: NTIS HC A02/MF A01

The impact of deteriorating quality and availability of aviation fuel on large transport aircraft engine fuel distribution and control systems and combustion systems is discussed. The advantages of liquid hydrogen as a replacement for fossil fuels are outlined, and the effects on engine design are considered. Long term low specific thrust developments are indicated. Author (ESA)

N84-22581# Rolls-Royce Ltd., Derby (England).
INDUSTRIAL AND MARINE ENGINE DERIVATIVES: A SPIN-OFF FROM AVIATION
W. J. R. Thomas Mar. 1981 10 p Presented at Brit. Aviation Seminar and Exhibition 1981, Delhi, 17-19 Mar. 1981 and Bangalore, 25-27 Mar. 1981
(PNR-90197; Reprint-914) Avail: NTIS HC A02/MF A01

Aviation derived gas turbine engine utilization for electric power generation, oil and gas pumping and compression, and the propulsion of ships, hydrofoils and hovercraft is illustrated. Author (ESA)

N84-22582# Rolls-Royce Ltd., Derby (England). Combustion Technology Div.
THE DESIGN AND DEVELOPMENT OF A LOW EMISSIONS TRANSPLY COMBUSTOR FOR THE CIVIL SPEY ENGINE
J. K. Bhangu, D. M. Snape, and B. R. Eardley Oct. 1983 18 p refs Sponsored by Procurement Executive of Ministry of Defence
(PNR-90198; Reprint-916) Avail: NTIS HC A02/MF A01

A low emissions tubo-annular combustor was developed for the Spey aero gas turbine engine. Ten combustors form the tubo-annular combustion system. Use of Transply pseudotranspiration cooling material enables a significant saving to be made in the utilization of wall cooling air. This air is used in optimizing the primary zone and intermediate zone stoichiometry which, combined with the use of an aerodynamic curved vane swirler, results in a substantial reduction in emission levels. Durability problems are overcome. Development constraints imposed by an existing engine design are described. The rig and engine test program leading to a full definition of the aerothermodynamics of the combustor is summarized. Author (ESA)

N84-22627# Aeronautical Research Associates of Princeton, Inc., N. J.
AIRCRAFT EXHAUST PLUME SIGNATURE PREDICTIONS FOR NON-AXISYMMETRIC MULTIPLE ENGINE INSTALLATIONS
B. E. Pearce, R. W. McCullough, and R. D. Thorpe *In* APL The 14th JANNAF Plume Technol. Meeting, Vol. 1 Nov. 1983 p 87-95 refs (For primary document see N84-22619 13-20)
Avail: NTIS HC A07/MF A01 CSCL 21/5

N84-22787# Joint Publications Research Service, Arlington, Va.
EFFECT OF ROTATION ON THERMAL STATE OF RUNNER BLADE THROUGH EFFECT ON HEAT TRANSFER ON COOLANT SIDE Abstract Only
V. Y. Mityakov and V. V. Ris *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 12 Transl. into ENGLISH from Teploenerg. (Moscow), no. 1, Jan. 1983 p 51-52 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

N84-22793# Joint Publications Research Service, Arlington, Va.
CALCULATION OF APPARENT MASSES IN BLADE RING Abstract Only
L. A. Tkacheva *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 15-16 Trans. into ENGLISH from Zh. Prikl. Mekhan. i Tekhn. Fiz. (Novosibirsk, USSR), no. 5, Sep. - Oct. 1983 p 56-62 Previously announced in IAA as A84-21115 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N84-22583*# Textron, Inc., Irvine, Calif. Systems Engineering Div.
TECHNOLOGY REVIEW OF FLIGHT CRUCIAL FLIGHT CONTROLS
H. A. Rediess and E. C. Buckley Apr. 1984 93 p refs
(Contract NAS1-17403)
(NASA-CR-172332; NAS 1.26:172332; HR-78500037) Avail: NTIS HC A05/MF A01 CSCL 01C

The results of a technology survey in flight crucial flight controls conducted as a data base for planning future research and technology programs are provided. Free world countries were surveyed with primary emphasis on the United States and Western Europe because that is where the most advanced technology resides. The survey includes major contemporary systems on operational aircraft, R&D flight programs, advanced aircraft developments, and major research and technology programs. The survey was not intended to be an in-depth treatment of the technology elements, but rather a study of major trends in systems level technology. The information was collected from open literature, personal communications and a tour of several companies, government organizations and research laboratories in the

United States, United Kingdom, France, and the Federal Republic of Germany. Author

N84-22584*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
V/STOL MANEUVERABILITY AND CONTROL
James A. Franklin and Seth B. Anderson Apr. 1984 50 p refs (NASA-TM-85939; A-9697; NAS 1.15:85939) Avail: NTIS HC A03/MF A01 CSCL 01C

Maneuverability and control of V/STOL aircraft in powered-lift flight is studied with specific considerations of maneuvering in forward flight. A review of maneuverability for representative operational mission tasks is presented and covers takeoff, transition, hover, and landing flight phases. Maneuverability is described in terms of the ability to rotate and translate the aircraft and is specified in terms of angular and translational accelerations imposed on the aircraft. Characteristics of representative configurations are reviewed, including experience from past programs and expectations for future designs. The review of control covers the characteristics inherent in the basic airframe and propulsion system and the behavior associated with ontrol augmentation systems. Demands for augmented stability and control response to meet certain mission operational requirements are discussed. Experience from ground-based simulation and flight experiments that illustrates the impact of augmented stability and control on aircraft design is related by example. S.L.

N84-22585*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A FORMULATION AND ANALYSIS OF COMBAT GAMES
M. Heymann (Technion - Israel Inst. of Tech.), Mark D. Ardema, and N. Rajan (Stanford Univ., Calif.) Apr. 1984 40 p refs (NASA-TM-85927; A-9678; NAS 1.15:85927) Avail: NTIS HC A03/MF A01 CSCL 12B

Combat which is formulated as a dynamical encounter between two opponents, each of whom has offensive capabilities and objectives is outlined. A target set is associated with each opponent in the event space in which he endeavors to terminate the combat, thereby winning. If the combat terminates in both target sets simultaneously, or in neither, a joint capture or a draw, respectively, occurs. Resolution of the encounter is formulated as a combat game; as a pair of competing event constrained differential games. If exactly one of the players can win, the optimal strategies are determined from a resulting constrained zero sum differential game. Otherwise the optimal strategies are computed from a resulting nonzero sum game. Since optimal combat strategies may frequently not exist, approximate or delta combat games are also formulated leading to approximate or delta optimal strategies. The turret game is used to illustrate combat games. This game is sufficiently complex to exhibit a rich variety of combat behavior, much of which is not found in pursuit evasion games. E.A.K.

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N84-22586 British Aerospace Dynamics Group, Bristol (England).
ELECTRO-MAGNETIC COMPATABILITY TEST FACILITY, BRISTOL
May 1982 67 p
(BAe-BT-10658) Avail: Issuing Activity

A computerized electromagnetic compatability data acquisition and plotting facility for conducted and radiated emissions up to 18GHz is described. Aerial correction factors, current probe transfer functions, cable losses and bandwidth factors are stored in the computer and removed from raw spectral data automatically. The emissions are plotted out directly in engineering units against the appropriate specification limits. For data presentation, graphical - specification; graphical with above specification emissions only; and tabular listing of emissions are possible. Continuous RF swept signal (CW or modulated) at very high electric field levels (200V/m typical) up to 18GHz are created. The facility can analyze problems at component or system level, and meets British Ministry of Defense, and NATLAS standards. Author (ESA)

N84-22587# ICON, Inc., San Diego, Calif.
DEVICE 2E6 (ACMS) AIR COMBAT MANEUVERING SIMULATOR INSTRUCTOR CONSOLE REVIEW Final Report
J. P. Charles Dec. 1983 132 p
(Contract N61339-82-M-0767)
(AD-A138972; NAVTRAEQUIPC-82-M-0767-1) Avail: NTIS HC A07/MF A01 CSCL 05/9

This report covers a survey of the IOS of a part-mission trainer, Training Device 2E6, an Air Combat Maneuvering Simulator. The device is significantly different from the WSTs surveyed previously (Device 2F119 and Device 2F112) in terms of the training objectives and in the characteristics of the trainer. The training objectives are concerned exclusively with the visual attack phase of air-to-air combat. Thus the environment and vehicle simulation requirements are limited and the training events consist of multiple relatively short duration flights. Training Device 2E6 consists of two domes inside which is projected the simulated visual world and which house the training mockups. Two IOSs are provided so that the two training mockups can be operated as independent trainers. The two trainers can also be tied together and operated as a single training device. The survey of the IOSs included reviewing technical documentation for the device, observing training operations and interviewing instructors, mission operators and technical personnel supporting the trainer. In addition, operating procedures were analyzed. The goal was to identify console design deficiencies and develop feasible solutions, for both short and long term. GRA

N84-22588# European Space Agency, Paris (France).
A UNIVERSAL 3-DIMENSIONAL WALL PRESSURE CORRECTION METHOD FOR CLOSED RECTANGULAR SUBSONIC WIND TUNNEL TEST SECTIONS (DISPLACEMENT, DOWNWASH, STREAMLINE CURVATURE)
Gerhard Schulz Jun. 1983 74 p refs Transl. into ENGLISH of "Ein Universelles Dreidimensionales Wanddruck Korrekturverfahren fuer Geschlossene Rechteckige Unterschallwindkanalmessstrecken (Verdraengung, Abwind, Kruemmung)" rept. no. DFVLR-FB-82-19 DFVLR (West Germany), Oberpfaffenhofen
(ESA-TT-800; DFVLR-FB-82-19) Avail: NTIS HC A04/MF A01; original German version available from DVFLR, Cologne DM 28,10

A wall pressure correction method for closed rectangular subsonic test sections, which corrects displacement, downwash, and streamline curvature for models of arbitrary size, shape, position and bulkiness is presented. The number of wall measuring points required is kept small so that the test duration need not be increased because of the correction. This is achieved by the selection of special wall pressure locations. The method can be extended to tunnels of any cross section. Experimental results are good for high lift measurements, and especially so for blockage correction in the presence of large wake regions behind the model. Author (ESA)

N84-22589# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
LA RECHERCHE AEROSPATIALE, BIMONTHLY BULLETIN, NUMBER 1983-4, 215/JULY-AUGUST
Claude Sevestre, ed. Paris ESA Jan. 1984 117 p refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale, Bull. Bimensuel (Paris), No. 1983-4, 215/Jul.-Aug.
(ESA-TT-823) Avail: NTIS HC A06/MF A01; print copy in ENGLISH available at ONERA, Paris FF 60; original report in FRENCH available at ONERA, Paris FF 60

Wind tunnel adaptive walls design and construction; error estimates for spectral approximation of Stokes equations; a

Eulerian-Lagrangian model for turbulent combustion; splitting schemes for solving hyperbolic and parabolic nonlinear problems (applications to Euler and Navier-Stokes equations); indirect measurement of the thermal-acoustic efficiency spectrum of a long turbulent burner; and numerical simulation of turbulence on minisystems with attached processors (in mono or multiprocessor configuration) are discussed. Author (ESA)

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N84-22590*# Science Applications, Inc., Schaumburg, Ill.
COST ESTIMATION MODEL FOR ADVANCED PLANETARY PROGRAMS, FOURTH EDITION
Daniel J. Spadoni Apr. 1983 107 p
(Contract NASw-3035)
(NASA-CR-173495; NAS 1.26:173495; SAI-1-120-768-C9) Avail: NTIS HC A06/MF A01 CSCL 22A

The development of the planetary program cost model is discussed. The Model was updated to incorporate cost data from the most recent US planetary flight projects and extensively revised to more accurately capture the information in the historical cost data base. This data base is comprised of the historical cost data for 13 unmanned lunar and planetary flight programs. The revision was made with a two fold objective: to increase the flexibility of the model in its ability to deal with the broad scope of scenarios under consideration for future missions, and to maintain and possibly improve upon the confidence in the model's capabilities with an expected accuracy of 20%. The Model development included a labor/cost proxy analysis, selection of the functional forms of the estimating relationships, and test statistics. An analysis of the Model is discussed and two sample applications of the cost model are presented. E.A.K.

N84-22591*# Science Applications, Inc., Schaumburg, Ill.
ADVANCED PLANETARY STUDIES Annual Report, 1 Feb. 1981 - 30 Apr. 1982
Aug. 1982 110 p
(Contract NASw-3035)
(NASA-CR-173496; NAS 1.26:173496; SAI-1-120-768-A9; AR-9) Avail: NTIS HC A06/MF A01 CSCL 22A

Results of planetary advanced studies and planning support provided by Science Applications, Inc. staff members to Earth and Planetary Exploration Division, OSSA/NASA, for the period 1 February 1981 to 30 April 1982 are summarized. The scope of analyses includes cost estimation, planetary missions performance, solar system exploration committee support, Mars program planning, Galilean satellite mission concepts, and advanced propulsion data base. The work covers 80 man-months of research. Study reports and related publications are included in a bibliography section. Author

N84-22592*# Science Applications, Inc., Schaumburg, Ill.
COMET NUCLEUS SAMPLE RETURN MISSION Technical Report, May - Aug. 1983
Sep. 1983 135 p refs Presented at SSEC Summer Study, Snowmass, Colo., 2 Aug. 1983
(Contract NASw-3622)
(NASA-CR-173501; NAS 1.26:173501; SAI-83/1152) Avail: NTIS HC A07/MF A01 CSCL 22A

A comet nucleus sample return mission in terms of its relevant science objectives, candidate mission concepts, key design/technology requirements, and programmatic issues is discussed. The primary objective was to collect a sample of undisturbed comet material from beneath the surface of an active comet and to preserve its chemical and, if possible, its physical integrity and return it to Earth in a minimally altered state. The secondary objectives are to: (1) characterize the comet to a level consistent with a rendezvous mission; (2) monitor the comet dynamics through perihelion and aphelion with a long lived lander; and (3) determine the subsurface properties of the nucleus in an area local to the sampled core. A set of candidate comets is discussed. The hazards which the spacecraft would encounter in the vicinity of the comet are also discussed. The encounter strategy, the sampling hardware, the thermal control of the pristine comet material during the return to Earth, and the flight performance of various spacecraft systems and the cost estimates of such a mission are presented. E.A.K.

N84-22593*# Science Applications, Inc., Schaumburg, Ill.
TITAN EXPLORATION WITH ADVANCED SYSTEMS. A STUDY OF FUTURE MISSION CONCEPTS Technical Report, Jan. - Jun. 1983
Sep. 1983 110 p refs Presented at SSEC Summer Study, Snowmass, Colo., 2 Aug. 1983
(Contract NASw-3622)
(NASA-CR-173499; NAS 1.26:173499; SAI-83/1151) Avail: NTIS HC A06/MF A01 CSCL 22A

The requirements, capabilities, and programmatic issues associated with science-intensive mission concepts for the advanced exploration of Saturn's largest satellite are assessed. The key questions to be answered by a Titan exploratory mission are: (1) the atmospheric composition; (2) the atmospheric structure; (3) the nature of the surface; and (4) the nature of the interior of Titan. Five selected mission concepts are described in terms of their design requirements. Mission hardware concepts include balloons and/or blimps which will allow both atmospheric and surface observations for a long period of time. Key aspects of performance analysis are presented. Mission profiles and cost summaries are given. Candidate payloads are identified for imaging and nonimaging orbiters, a buoyant station, a haze probe, and a penetrator. A.R.H.

N84-22594*# Science Applications, Inc., Schaumburg, Ill.
PERFORMANCE ASSESSMENT OF PLANETARY MISSIONS AS LAUNCHED FROM AN ORBITING SPACE STATION
Alan Friedlander 27 Jul. 1982 33 p refs Presented at Summer Study Retreat, Snowmass, Colo.
(Contract NASw-3622)
(NASA-CR-173498; NAS 1.26:173498) Avail: NTIS HC A03/MF A01 CSCL 22A

Results presented are intended to assist planners and the mission analysis community in assessing the performance impact (pro or con) of launching planetary missions from an orbiting space station as compared to the usual, ground-based Shuttle launch of such missions. The analyses comprising this assessment include: (1) a basic understanding and description of the space station launch problem; (2) examination of alternative injection strategies and selection of the most appropriate strategy for minimizing performance penalties; and (3) quantitative comparison of station-launched and Shuttle-launched performance over a wide energy/mass range of planetary mission opportunities. Data for each mission covers a full 360 deg of possible nodal location of the space station orbit. The main results are that planetary missions can be launched from a space station within acceptable penalty bounds, and that the station serving as a staging base/propellant depot can benefit some missions requiring large payload mass or high injection energy. S.L.

N84-22595*# Science Applications, Inc., Schaumburg, Ill.
A REVIEW OF IN SITU PROPELLANT PRODUCTION TECHNIQUES FOR SOLAR SYSTEM EXPLORATION
Stephen J. Hoffman Apr. 1983 64 p refs
(Contract NASw-3622)
(NASA-CR-173494; NAS 1.26:173494; SAI-A-120-340-S15) Avail: NTIS HC A04/MF A01 CSCL 22A

Representative studies done in the area of extraterrestrial chemical production as it applies to solar system exploration are presented. A description of the In Situ Propellant Production (ISPP) system is presented. Various propellant combinations and direct applications along with the previously mentioned benefits and liens are discussed. A series of mission scenarios is presented which

is studied in the greatest detail. A general description of the method(s) of analysis used to study each mission is provided. Each section will be closed by an assessment of the performance advantage, if any, that can be provided by ISPP. A final section briefly summarizes those missions which, as a result of the studies completed thus far, should see a sizable benefit from the use of ISPP. M.A.C.

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

No abstracts in this category.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air).*

N84-22596*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
DEVICE AND METHOD FOR FRICTIONALLY TESTING MATERIALS FOR IGNITABILITY Patent Application
Frank J. Benz, Randall C. Shaw, and David S. Dixon, inventors (to NASA) (Lockheed Engineering and Management Services Co., Inc.) Filed 17 Jan. 1984 13 p
(NASA-Case-MSC-20622-1; US-Patent-Appl-SN-571616) Avail: NTIS HC A02/MF A01 CSCL 14B

Test apparatus for determining ignition characteristics of various metal in oxidizer environments has a chamber through which the oxidizing agent flows, and means for mounting a stationary test sample therein, a powered, rotating shaft in the chamber rigidly mounts a second test sample. The shaft is axially movable to bring the samples into frictional engagement and heated to the ignition point. Instrumentation connected to the apparatus provides for observation of temperatures, pressures, loads on and speeds of the rotating shaft, and torques whereby components of stressed oxygen systems are selected which avoid accidental fires under working conditions. NASA

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N84-22597*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SATELLITE SERVICES CATALOG: TOOLS AND EQUIPMENT
Sep. 1983 154 p refs Original contains color illustrations
(NASA-TM-85627; JSC-19211; NAS 1.15:85627) Avail: NTIS HC A08/MF A01 CSCL 22D

A catalog of available and proposed Shuttle crew aids, devices, tools, and support equipment is presented, and is designed to be utilized by all of the satellite community, including the U.S. military and government agencies as well as commercial customers both foreign and domestic. Each piece of hardware listed in this catalog falls into one of three categories: (1) Standard Services - normally manifested and flown; (2) Auxiliary Services - available, but must be manifested on the particular missions; and (3) Project Servicing Capability - hardware yet to be developed or funded - advanced planning stage only and subject to NASA approval. For each cataloged hardware item, a brief functional description is provided, along with a photograph and/or drawing; the writeup also identifies reference documents which discuss the item in more detail (where such documentation exists) and a NASA project engineer or subsystem manager who may be consulted for further information. Specifications and dimensions are given in either British or metric units, according to the specifications to which that particular equipment was designed. M.A.C.

N84-22598*# Texas Univ., Austin. Dept. of Aerospace Engineering and Engineering Mechanics.
DYNAMICS ANALYSIS OF ELECTRODYNAMIC SATELLITE TETHERS. EQUATIONS OF MOTION AND NUMERICAL SOLUTION ALGORITHMS FOR THE TETHER Final Report
Paul E. Nacozy 31 Jan. 1984 46 p
(Contract NAS9-16744)
(NASA-CR-171777; NAS 1.26:171777) Avail: NTIS HC A03/MF A01 CSCL 22B

The equations of motion are developed for a perfectly flexible, inelastic tether with a satellite at its extremity. The tether is attached to a space vehicle in orbit. The tether is allowed to possess electrical conductivity. A numerical solution algorithm to provide the motion of the tether and satellite system is presented. The resulting differential equations can be solved by various existing standard numerical integration computer programs. The resulting differential equations allow the introduction of approximations that can lead to analytical, approximate general solutions. The differential equations allow more dynamical insight of the motion. M.A.C.

N84-22599# Air Force Geophysics Lab., Hanscom AFB, Mass.
A NEW SATELLITE INSTRUMENT FOR YAW AND PITCH MEASUREMENTS Instrumentation Papers
J. P. McIsaac 13 Sep. 1982 26 p
(AF Proj. 6690)
(AD-A138729; AFGL-TR-82-0265; AFGL-IP-312) Avail: NTIS HC A03/MF A01 CSCL 22/3

A new device for measuring spacecraft attitude was flown on the Air Force S3 -4 satellite. This report describes instrumentation, measurement technique, and operating results. Instrument attack angles were measured during night and day periods of most orbits. Attitude history plots and tables are given for the experiment from April to August 1978. Author (GRA)

N84-22600# National Aerospace Lab., Amsterdam (Netherlands). Informatics Div.
REPROGRAMMABLE ONBOARD MISSION OF IRAS
U. Posthuma deBoer and G. J. Hameetman 9 Mar. 1983 14 p In DUTCH; ENGLISH summary Submitted for publication
(NLR-MP-83014-U) Avail: NTIS HC A02/MF A01

Onboard software was developed for the Infrared Astronomical Satellite (IRAS). During the first week after launch a hardware failure occurred in the satellite, seriously endangering mission success. By rewriting onboard software it is possible to cope with this problem. The observations can be fully carried out according to plan. Author (ESA)

N84-22621# Science Applications, Inc., Los Angeles, Calif.
APPLICATION OF THE CONTAM 3 COMPUTER MODEL TO THE PREDICTION OF HEATING, FORCES, AND CONTAMINATION ON A COMMUNICATIONS SATELLITE
R. J. Hoffman *In* APL The 14th JANNAF Plume Technol. Meeting, Vol. 1 Nov. 1983 p 9-39 refs (For primary document see N84-22619 13-20)
Avail: NTIS HC A07/MF A01 CSCL 22/1

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation, e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

N84-22601* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
PRE-STRESSED THERMAL PROTECTION SYSTEMS Patent
Thomas J. Dunn, inventor (to NASA) Issued 3 Apr. 1984 7 p Filed 15 Sep. 1982
(NASA-Case-MSC-20254-1; US-Patent-4,439,968; US-Patent-Appl-SN-418137; US-Patent-Class-52-404; US-Patent-Class-52-506; US-Patent-Class-244-158A) Avail: US Patent and Trademark Office CSCL 22B

A hexagonal protective and high temperature resistant system for the Space Shuttle Orbiter consists of a multiplicity of pockets formed by hexagonally oriented spacer bars secured on the vehicle substructure. A packing of low density insulating batt material 18 in each pocket, and a thin protective panel of laterally resilient advanced carbon-carbon material surmounting the peripherals bars and packing. Each panel has three stepped or offset lips on contiguous edges. At the center of each pocket is a fully insulated stanchion secured to and connecting the substructure and panel for flexing the panel toward the substructure and thereby prestressing the panel and forcing the panel edges firmly against the spacer bars.

Official Gazette of the U.S. Patent and Trademark Office

N84-22602*# Engineering Analysis, Inc., Huntsville, Ala.
ATMOSPHERIC TURBULENCE SIMULATION FOR SHUTTLE ORBITER Summary Report
Frank B. Tatom and S. Ray Smith 31 Aug. 1979 68 p refs
(Contract NAS8-33076)
(NASA-CR-171013; NAS 1.26:171013; EAI-TR-79-004) Avail: NTIS HC A04/MF A01 CSCL 22B

An improved non-recursive model for atmospheric turbulence along the flight path of the Shuttle Orbiter is developed which provides for simulation of instantaneous vertical and horizontal gusts at the vehicle center-of-gravity, and also for simulation of instantaneous gust gradients. Based on this model the time series for both gusts and gust gradients are generated and stored on a series of magnetic tapes. Section 2 provides a description of the various technical considerations associated with the turbulence simulation model. Included in this section are descriptions of the digital filter simulation model, the von Karman spectra with finite upper limits, and the final non recursive turbulence simulation model which was used to generate the time series. Section 2 provides a description of the various technical considerations associated with the turbulence simulation model. Included in this section are descriptions of the digial filter simulation model, the von Karman spectra with finite upper limits, and the final non recursive turbulence simulation model which was used to generate the time series. Section 3 provides a description of the time series as currently recorded on magnetic tape. Conclusions and recommendations are presented in Section 4. M.A.C.

N84-22603*# Chrysler Corp., New Orleans, La. Data Management Services Dept.
POST-TEST DATA REPORT FOR THE SPACE SHUTTLE FULL-SCALE AFRSI SEQUENCE OF ENVIRONMENTS TEST (OS-305-1 TO -5) IN THE NASA/AMES RESEARCH CENTER 11X11-FOOT WIND TUNNEL
B. A. Marshall (Rockwell International) Mar. 1984 70 p refs
(Contract NAS9-16283)
(NASA-CR-167684; NAS 1.26:167684; DMS-DR-2515) Avail: NTIS HC A04/MF A01 CSCL 22B

The Advanced Flexible Reusable Surface Insulation (AFRSI) test article was wind tunnel tested. The AFRSI was exposed to a simulated ascent airloads environment and data was obtained which could be used to support the AFRSI certification program. The AFRSI sequence of environments also included radiant heating (1500 degrees Fahrenheit) and wind/rain environments. The test article was wind/rain conditioned before each wind tunnel entry and was thermally conditioned after each wind tunnel entry. The AFRSI failed and the test was aborted before reaching the ascent environment. The AFRSI test article sequentially exposed to 50 wind/rain and 49 simulated entry thermal missions, as well as four wind tunnel entries equivalent to 40 ascent missions. M.A.C.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications.*

N84-22604# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
STOCHASTIC TECHNIQUES APPLIED TO THE SMOOTHING TREATMENT OF BIAS AND COMPRESSION OF ARTIFICIAL SATELLITE TRACKING AND TELEMETRY DATA [TECNICAS ESTOCASTICAS APLICADAS A SUAVIZACAO TRATAMENTO DE TENDENCIOSIDADES E COMPRESSAO DE DADOS DE RASTREAMENTO OU TELEMETRIA DE SATELITES ARTIFICIAIS]
Valcir Orlando Oct. 1983 139 p refs In PORTUGUESE; ENGLISH summary
(INPE-2909-TDL/148) Avail: NTIS HC A07/MF A01

Three procedures related with preprocessing of artificial satellite tracking and telemetry data, developed with the aid of stochastic techniques are presented. The first of them consists of a data smoothing procedure by curve fitting developed by the application of the Kalman filter combined with an adaptive technique of state noise evaluation. The second procedure, developed in order to allow an automatic treatment of bias errors in dynamics systems observation data, makes Kalman filter state estimation possible by direct processing of the bias errors corrupted observations. For this, a dynamic compensation scheme is used. Finally, the third procedure, classified as a data compression procedure, has the objective of obtaining, in certain conditions, a processing speed gain in Kalman filter applications to nonlinear dynamic systems state estimation. Validation tests of the procedures were made by digital computer simulation using simulated data related with a low altitude artificial satellite orbit. Author

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support.* For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics.*

N84-22605* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APPARATUS FOR RELEASABLY CONNECTING FIRST AND SECOND OBJECTS IN PREDETERMINED SPACE RELATIONSHIP Patent
Joseph A. Chandler, inventor (to NASA) Issued 14 Feb. 1984 11 p Filed 14 Apr. 1982
(NASA-Case-MSC-18969-1; US-Patent-4,431,333; US-Patent-Appl-SN-368189; US-Patent-Class-403-322; US-Patent-Class-244-161) Avail: US Patent and Trademark Office CSCL 22B

A releasable apparatus that connects first and second space objects, such as a spacecraft and a space vehicle, in predetermined

spaced relationship is described. The apparatus comprises at least one probe member mounted on the first object, having an elongated shank portion, the distal end of which is provided with a tapered nose portion. At least one drogue assembly is mounted on the second space object for releasably capturing the probe member upon the first and second objects being brought into close proximity with each other.

Official Gazette of the U.S. Patent and Trademark Office

N84-22606 Michigan Univ., Ann Arbor.
OPTIMAL MANEUVERS OF ORBITAL TRANSFER VEHICLES Ph.D. Thesis
John Michael Hanson 1983 162 p
Avail: Univ. Microfilms Order No. DA8402291

The use of aerodynamic forces to assist in orbital transfer can significantly reduce the fuel consumption as compared to a purely propulsive transfer. The sole physical performance parameter that must be specified is the maximum lift-to-drag ratio of the vehicle. The generality of the results enables orbital flight and high atmospheric flight at hypersonic speeds to be considered as an integral problem in astrodynamics under a global optimization to find the combined optimal trajectory for the orbital transfer vehicle. The use of Chapman's variables permits the formulation of a set of dimensionless equations for atmospheric flight with a smooth transition to flight in the vacuum. A spherical planet with a stationary, exponential atmosphere is assumed, and the optimal control problem for flight in the atmosphere is formulated. No approximations about the nature of the trajectory are made, so that the results are fully optimal for the planet model used.

Dissert. Abstr.

N84-22607*# Boeing Aerospace Co., Kent, Wash.
DEFINITION OF TECHNOLOGY DEVELOPMENT MISSIONS FOR EARLY SPACE STATIONS. LARGE SPACE STRUCTURES, PHASE 2, MIDTERM REVIEW
22 Mar. 1984 105 p
(Contract NAS8-35043)
(NASA-CR-171004; NAS 1.26:171004) Avail: NTIS HC A06/MF A01 CSCL 22B

The large space structures technology development missions to be performed on an early manned space station was studied and defined and the resources needed and the design implications to an early space station to carry out these large space structures technology development missions were determined. Emphasis is being placed on more detail in mission designs and space station resource requirements. Author

N84-22608*# Perkin-Elmer Corp., Danbury, Conn.
OPTIMIZATION OF THERMAL SYSTEMS WITH SENSITIVE OPTICS, ELECTRONICS, AND STRUCTURES Final Report
R. G. Bettini and F. A. Costello Washington NASA Apr. 1984 71 p refs
(Contract NAS1-17152)
(NASA-CR-3745; NAS 1.26:3745; ER-599A) Avail: NTIS HC A04/MF A01 CSCL 22B

A strategy was investigated by which thermal designers for spacecraft could devise an optimal thermal control system to maintain the required temperatures, temperature differences, changes in temperature, and changes in temperature differences for specified equipment and elements of the spacecraft's structure. Thermal control is to be maintained by the coating pattern chosen for the external surfaces and heaters chosen to supplement the coatings. The approach is to minimize the thermal control power, thereby minimizing the weight of the thermal control system. Because there are so many complex computations involved in determining the optimal coating design a computerized approach was contemplated. An optimization strategy including all the elements considered by the thermal designer for use in the early stages of design, where impact on the mission is greatest, and a plan for implementing the strategy were successfully developed. How the optimization process may be used to optimize the design of the Space Telescope as a test case is demonstrated. Author

N84-22609*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SPACE PROBE/SATELLITE EJECTION APPARATUS FOR SPACECRAFT Patent Application
Harold M. Smyly, Charles D. Miller, Richard A. Cloyd, and Clarence Heller, inventors (to NASA) Filed 5 Apr. 1984 18 p
(NASA-Case-MFS-15429-1; US-Patent-Appl-SN-596959) Avail: NTIS HC A02/MF A01 CSCL 22B

An ejection apparatus for spinning and propelling objects for ejection from a spacecraft at a desired velocity and rotational speed is discussed. The apparatus includes a launch cradle on which the space object to be ejected rests. The cradle is rotatably supported by a central hub secured to the upper end of the pneumatic cylinder piston shaft. Release mechanisms consisting of a retractable pin and locking lug is utilized to hold the cradle and object to be ejected. The release mechanism has a fixed barrier member which holds the retractable pin in engagement with the locking lug until release by upward movement of the launch cradle beyond the barrier height. NASA

N84-22610*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
TANKER ORBIT TRANSFER VEHICLE AND METHOD Patent Application
Gregory G. Ryan, inventor (to NASA) Filed 8 Feb. 1983 23 p
(NASA-Case-MSC-20543-1; US-Patent-Appl-SN-580574) Avail: NTIS HC A02/MF A01 CSCL 22B

A method and apparatus for transportation between orbits are presented. A tanker orbit transfer vehicle includes two stages each of which includes a fuel container. The first stage may be left in an intermediate parking orbit while the second stage goes on to carry out a mission, thereafter to return to rendezvous and dock with the first stage. Fuel carried by the first stage may be utilized for travel of the two stages between the starting orbit and the parking orbit, and for return to the starting orbit. An aerobrake may be included in the system for use in the return to the initial orbit. NASA

N84-22611*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
CONSTANT FORCE FRICTION DAMPER Patent Application
George E. Campbell, inventor (to NASA) (Rockwell International Corp., Downey, Calif.) Filed 8 Feb. 1983 9 p Sponsored by NASA
(NASA-Case-MSC-20505-1; US-Patent-Appl-SN-519660) Avail: NTIS HC A02/MF A01 CSCL 22B

A friction type damper unit has opposed conical wedge rings, on a wedge bolt plunger extending axially into a barrel connected to the body of a space vehicle, as in the payload bay of the space shuttle obiter. The plunger is connected to the softly sprung payload, as the inertial upper stage (IUS) in the payload bay of the vehicle. Friction shoes are slideable on the barrel and expandable by the wedge rings. The wedge rings are connected to the plunger through opposed balanced stacks of Belleville washers which provide the required high spring constant and balanced reversing forces. NASA

N84-22612*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SPACE STATION ARCHITECTURE, MODULE, BERTHING HUB, SHELL ASSEMBLY, BERTHING MECHANISM AND UTILITY CONNECTION CHANNEL Patent Application
Marc M. Cohen, inventor (to NASA) Filed 9 Mar. 1984 25 p
(NASA-Case-ARC-11505-1; US-Patent-Appl-SN-588036) Avail: NTIS HC A02/MF A01 CSCL 22B

The geometric form of a space station is presented that includes a description of a plurality of modules and berthing hubs, joined by interconnections which are sideways connectable. The modules and hubs are fastened together in a triangular configuration in three dimensions. The interconnections include a pair of opposed, axially aligned, flanged ports and a clamp latch formed from a plurality of sections hinged along their length and extending circumferentially around the flanged ports. A hermetic seal is formed

between the ports. A utilities connection channel extends between the ports. The channel has a shell with utilities connectors movable between an extended position to mating connectors in the modules and a withdrawn position. Assembly sequence and common module shell structure is detailed. NASA

N84-22613*# Boeing Aerospace Co., Seattle, Wash.
SPACE STATION SYSTEMS TECHNOLOGY STUDY. VOLUME 3: TECHNOLOGY AND ADVANCEMENT PROGRAM PLAN Final Report
Feb. 1984 73 p refs 3 Vol.
(Contract NAS8-34893)
(NASA-CR-171016; NAS 1.26:171016; D180-27935-3) Avail: NTIS HC A04/MF A01 CSCL 22B

The development of the integrated technology advancement plan was initiated with the results of the advanced platform system technology study (APSTS). Descriptions for the development of each viable technology advancement were drawn from the trade studies. Major elements were time-phased, allowing the definition of a development schedule consistent with the space station program when possible. Schedules show the major milestones of the development programs including test required as described in the logic flow diagrams. B.G.

N84-22614*# Boeing Aerospace Co., Seattle, Wash.
SPACE STATION SYSTEMS TECHNOLOGY STUDY. VOLUME 1: EXECUTIVE SUMMARY Final Report
Feb. 1984 111 p refs 3 Vol.
(Contract NAS8-34893)
(NASA-CR-171014; NAS 1.26:171014; D180-27935-1) Avail: NTIS HC A06/MF A01 CSCL 22B

The four study areas addressed are: (1) attitude control, (2) data management, (3) long-life thermal management, and (4) automated housekeeping integration. The design concepts in each area were refined. The cost benefits, schedules, and life cycle costs for the options were evaluated. Technology advancement plans were prepared for each of the selected items, and documentation was prepared. B.G.

N84-22615*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HIGH VOLTAGE-HIGH POWER COMPONENTS FOR LARGE SPACE POWER DISTRIBUTION SYSTEMS
David D. Renz 1984 16 p refs To be presented at the 19th Intersoc. Energy Conversion Eng. Conf., San Francisco, 19-24 Aug. 1984
(NASA-TM-83648; E-2093; NAS 1.15:83648) Avail: NTIS HC A02/MF A01 CSCL 22B

Space power components including a family of bipolar power switching transistors, fast switching power diodes, heat pipe cooled high frequency transformers and inductors, high frequency conduction cooled transformers, high power-high frequency capacitors, remote power controllers and rotary power transfer devices were developed. Many of these components such as the power switching transistors, power diodes and the high frequency capacitor are commercially available. All the other components were developed to the prototype level. The dc/dc series resonant converters were built to the 25 kW level. S.L.

N84-22616# Army Signals Warfare Lab., Vint Hill Farms Station, Va.
ANALYSIS OF SPACECRAFT CHARGING, PARTICLE BEAMS AND GEOPHYSICAL DATA BASES Final Report, May 1980 - May 1983
K. H. Bhavnani, W. J. McNeil, and M. F. Tautz 31 Jul. 1983 123 p
(Contract F19628-80-C-0127; AF Proj. 9993)
(AD-A138632; AFGL-TR-83-0140) Avail: NTIS HC A06/MF A01 CSCL 22/2

This report documents investigations and computer programs developed for study of spacecraft charging, ionization effects of beams, and analyses of geophysical data bases. Spacecraft charging studies have been performed utilizing NASCAP and the associated program MATCHG. Specific SCATHA satellite charging events were simulated in detail. Special studies of HELIOS 1, GEOS, and a simple Space Based Radar are also described. Investigations for plasma definition and for determining threshold conditions for materials charging are summarized. Ionization and charging characteristics due to electron and beam currents are simulated for simple spherical or cylindrical symmetries, and includes flight simulation predictions. Particle trajectory studies were conducted for some basic electric field configurations, as well as for tracking particle beams in the geomagnetic field. Atmospheric density and winds have been determined for a series of rocket sphere flights in the lower thermosphere. An interactive graphics program (SUATEK) has been advanced. GRA

N84-22617 Virginia Polytechnic Inst. and State Univ., Blacksburg.
APPLICATION OF CONTROL THEORY TO LARGE FLEXIBLE STRUCTURES USING THE INDEPENDENT MODAL-SPACE CONTROL METHOD Ph.D. Thesis
Joram Shenhar 1983 215 p
Avail: Univ. Microfilms Order No. DA8402806

The control problem of a large order flexible system in the form of a beam-lattice is presented using the Independent Modal-Space Control (IMSC) method. The method is based on a transformation of the system equations of motion to modal space, yielding internally independent modal equations of motion. The control laws are designed in the modal space, permitting independent control of each mode, providing complete decoupling of the equations of motion. Linear optimal control with quadratic performance index is designed to control the response of the elastic as well as the rigid body modes, using the IMSC method. Actuators placement is of fundamental importance in the control of two dimensional domains if IMSC is used. A method is presented as to the selection of actuators configuration in order to avoid singularity in the mode participation matrix, guaranteeing system controllability. Dissert. Abstr.

N84-22618 Virginia Polytechnic Inst. and State Univ., Blacksburg.
ACTIVE CONTROL OF DISTRIBUTED STRUCTURES Ph.D. Thesis
Lawrence Michael Silverberg 1983 127 p
Avail: Univ. Microfilms Order No. DA8402807

The partial differential equations of motion for an uncontrolled distributed structure can be transformed into a set of independent modal equations by means of the system eigenfunctions. In vibration analysis, the modal coordinates are referred tc as natural coordinates. Active control forces generally recouple the modal equations so that the natural coordinates for the open-loop (uncontrolled) system cease to be natural coordinates for the closed-loop (controlled) system. Control of this form is known as coupled control. In contrast, it is shown that a method known as the independent modal-space control method is a natural control method; i.e., the natural coordinates of the open-loop system and of the closed-loop system are identical. Furthermore, it is shown that natural control provides a unique and globally optimal closed-form solution to the linear optimal control problem for the distributed structure. The optimal control forces are ideally distributed. If implementation of distributed control is not feasible, then the distributed control forces can be approximated by finite-dimensional control forces. Dissert. Abstr.

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography.*

No abstracts in this category.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N84-22619# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
THE 14TH JANNAF PLUME TECHNOLOGY MEETING, VOLUME 1
Debra Sue Eggleston, ed. Nov. 1983 136 p refs Meeting held in China Lake, Calif., 15-17 Nov. 1983 3 Vol.
(Contract N00024-83-C-5301)
(AD-A139654; CPIA-Publ-384-Vol-1) Avail: NTIS HC A07/MF A01 CSCL 21/2

Papers on the following areas are included: prediction of exhaust plume contamination of spacecraft surfaces, plume flow field prediction, gun muzzle flow field prediction, and exhaust plume radiation. For individual titles, see N84-22620 through N84-22630.

N84-22620*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
MMH-NITRATE AND PLUME DEPOSITS FROM NTO/MMH ENGINES
E. A. Lawton and C. M. Moran *In* APL The 14th JANNAF Plume Technol. Meeting, Vol. 1 Nov. 1983 p 1-7 refs (For primary document see N84-22619 13-20)
(Contract NAS7-918)
Avail: NTIS HC A07/MF A01 CSCL 21H

The chemical properties of MMH-nitrate were characterized with emphasis on its role in plume deposits. The data in the literature indicated that the plume deposits from NTO/MMH engines were essentially methylhydrazinium nitrate (MMH-nitrate). The chemical literature did not contain data on its properties. Therefore, MMH-nitrate was synthesized and attempts were made to correlate its properties with the results found elsewhere. MMH-nitrate is a minor consistuent of plume deposits from NTO/MMH engines, but its properties exert a dominant effect on the nature of the deposits. MMH-nitrate is an extremely hygroscopic white solid, melting at 38 to 41 C. It solvates readily and retains water and MMH hydrate tenaciously. The properties of MMH-nitrate measured include differential scanning calorimetry (DSC) and mass spectral data. These data, correlated with older literature, are discussed from the viewpoint of the mechanism of formation of the plume deposits. Author

N84-22621# Science Applications, Inc., Los Angeles, Calif.
APPLICATION OF THE CONTAM 3 COMPUTER MODEL TO THE PREDICTION OF HEATING, FORCES, AND CONTAMINATION ON A COMMUNICATIONS SATELLITE c15
R. J. Hoffman *In* APL The 14th JANNAF Plume Technol. Meeting, Vol. 1 Nov. 1983 p 9-39 refs (For primary document see N84-22619 13-20)
Avail: NTIS HC A07/MF A01 CSCL 22/1

The CONTAM 3 computer model recently was applied to the design of the OLYMPUS (previously L-SAT) commercial communication satellite. Nearly the full range of CONTAM model capabilities were exercised during this application. Extensive use of the TPP subprogram resulted in the identification and quantification of unburned propellant droplets, unburned propellant vapor, and contaminant wall film, present in the exhaust plume of the R-4D-11 liquid apogee engine and R6C reaction control and translational bipropellant thrusters. The MULTRAN subprogram was used to define high altitude multiphase nozzle and plume flowfield, including nozzle boundary layer expansion into the backflow region. Chemical kinetics were considered along streamlines. The resulting plume flowfield was sorted along streamlines and formatted to be compatible with both the NASA PLIMP code for the prediction of impingement heating, forces, and moments, and with the CONTAM 3/SURFACE subprogram for the prediction of impingement flux, abrasion, deposition, and contaminant effects. Both PLIMP and CONTAM 3/SURFACE were exercised. Author

N84-22622# Science Applications, Inc., Los Angeles, Calif.
CONTAM 3 PLUS IMPROVED CONTAM 3 USABILITY
R. J. Hoffman *In* APL The 14th JANNAF Plume Technol. Meeting, Vol. 1 Nov. 1983 p 41-45 refs (For primary document see N84-22619 13-20)
(Contract F04611-83-C-0029)
Avail: NTIS HC A07/MF A01 CSCL 21/8

The CONTAM 3 computer code for the analysis of high altitude rocket nozzle and exhaust plume flowfields, and the prediction of plume contamination effects, is presently being modified to increase its usability. The modifications underway are briefly discussed, the status of the code development summarized and recent User Bulletins concerning use of the CONTAM 3 code are discussed. Author

N84-22623# Grumman Aerospace Corp., Bethpage, N.Y.
SOLID CARBON OXIDATION AND RADIATION IN EXHAUST PLUMES
R. Ambruso and M. Slack *In* APL The 14th JANNAF Plume Technol. Meeting, Vol. 1 Nov. 1983 p 47-55 refs (For primary document see N84-22619 13-20)
Avail: NTIS HC A07/MF A01 CSCL 21/8

The persistence of carbon particles in a rocket or aircraft exhaust plume is governed by the heterogeneous oxidation rate, and this in turn determines the IR emission intensities from surviving particles. Literature on the heterogeneous carbon oxidation rate is reviewed and an equivalent pseudo-gas oxidation reaction and rate coefficient are developed specifically for use in plume fluid mechanics codes which treat only phase oxidation reactions coefficient k = 1.5 x 10(6) T(1/2) r/1 exp (-39300/RT) cubic cm 1/mole 1/s for the reaction Cs + 02 CO22, where r is the carbon particle radius, is recommended for sea level exhaust plumes. Earlier rate data by Slack and by Wilson are critically reviewed. For a nominal tactical motor whose exhaust initially contains 1% carbon, plume properties were computed for a range of altitudes and thrust levels. The impact of carbon oxidation on the IR signature is presented. Author

N84-22624# Aeronautical Research Associates of Princeton, Inc., N. J.
EXHAUST PLUME INDUCED FLUCTUATIONS IN THE INDEX OF REFRACTION AT OPTICAL WAVELENGTHS
R. W. McCullough and B. E. Pearce *In* APL The 14th JANNAF Plume Technol. Meeting, Vol. 1 Nov. 1983 p 57-66 refs (For primary document see N84-22619 13-20)
Avail: NTIS HC A07/MF A01 CSCL 21/8

Modern weapon systems are becoming increasingly dependent upon electro-optical communication links. Turbulent flowfields induce substantial degradation of optical propagation. The results of calculations of the turbulence induced fluctuations in the index of refraction for both aircraft and missile exhaust plumes are presented. A second-order closure model is used to predict the fluctuations and correlations of temperature, CO2, and H2O in an aircraft exhaust plume. These correlations are used to compute the index of refraction structure constant for optical wavelengths. This calculation is compared to a simpler formation using the g-equation extension to the two-equation turbulence kinetic energy model currently utilized in the JANNAF SPF. Results are presented for the index of refraction structure constant field in the plume of a typical modern fighter aircraft. In addition, the index of refraction structure constant obtained from the two-equation model is presented for the plume of a small, solid propellant rocket. The effects of the turbulence induced index of refraction fluctuations on optical imaging, laser communications, and laser weaponry are briefly discussed. Author

N84-22625*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
MULTIPLE POINT SOURCE MODEL FOR THREE DIMENSIONAL

PLUME FLOW FIELDS

C. S. Guernsey *In* APL The 14th JANNAF Plume Technol. Meeting, Vol. 1 Nov. 1983 p 67-76 refs (For primary document see N84-22619 13-20)

Avail: NTIS HC A07/MF A01 CSCL 20/8

The Galileo spacecraft utilizes plume shields to protect contamination sensitive spacecraft surfaces from contaminants in the plumes of the bipropellant thrusters which are used for attitude control and trajectory correction maneuvers. The reexpansion of these plumes around the plume shields is analyzed using the direct simulation Monte Carlo method in three dimensional form. However, it was not feasible to extend these calculations to include interactions with contamination sensitive surfaces because of complex spacecraft geometry. Further, it is extremely inefficient and unnecessary to utilize the direct simulation Monte Carlo method to analyze the essentially collisionless regions of the flow field. An analytical model, based on an ellipsoidal velocity distribution function, was developed which allows extrapolation of these plume flow fields while preserving most of the nonequilibrium phenomena predicted by the Monte Carlo computations. Specifically, continued species separation due to inertial nonequilibrium is treated in the collisionless regime by using kinetic data sampled for each species at the boundary of the Monte Carlo calculation. The result is a computationally tractable model for the far field which are incorporated into conventional plume impingement or contamination computer codes. Author

N84-22626*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

OPERATIONAL UPDATE TO THE RCS FLOW FIELD OF THE SPACE SHUTTLE ORBITER

John W. Alred *In* APL The 14th JANNAF Plume Technol. Meeting, Vol. 1 Nov. 1983 p 77-86 refs (For primary document see N84-22619 13-20)

Avail: NTIS HC A07/MF A01 CSCL 21H

The flow field for the Reaction Control System (RCS) jets of the Space Shuttle Orbiter was calculated from the nozzle throat to the far field region. The calculations involve the use of recently improved rocket engine nozzle/plume codes and the source flow analytic model. The flow solution is discussed and used to predict impingement forces and moments as experienced by the Space Shuttle Orbiter during on-orbit operations. The flow solution is also used to analyze forces and moments on a satellite during Orbiter proximity operations. The results of these two analyses are compared to flight data obtained from flights STS-6 and STS-7. The comparison shows good agreement between experimental values and the predicted values from the latest plume models. Author

N84-22627# Aeronautical Research Associates of Princeton, Inc., N. J.

AIRCRAFT EXHAUST PLUME SIGNATURE PREDICTIONS FOR NON-AXISYMMETRIC MULTIPLE ENGINE INSTALLATIONS **c07**

B. E. Pearce, R. W. McCullough, and R. D. Thorpe *In* APL The 14th JANNAF Plume Technol. Meeting, Vol. 1 Nov. 1983 p 87-95 refs (For primary document see N84-22619 13-20)

Avail: NTIS HC A07/MF A01 CSCL 21/5

The exhaust plume flowfields and infrared radiation in a mid-IR bandpass are calculated for a single axisymmetric jet, a 5:1 aspect ratio rectangular nozzle, and two side-by-side axisymmetric nozzles with plume exit conditions typical of an aircraft in subsonic flight at non-afterburning thrust. The emphasis is on illustrating the different spatial distributions of the radiance from these non-axisymmetric flows. A unique combination of a three dimensional flowfield code and a radiative transfer code were used for the predictions. Plume and nozzle hot parts radiance distributions, spectra, and intensities are compared. The objective is to suggest that it is currently practical to make predictions of spatially resolved signatures for non-axisymmetric plumes of this class. Author

N84-22628# Calspan Advanced Technology Center, Buffalo, N.Y. Dept. of Physical Sciences.

MACH NUMBER AND DENSITY EFFECTS IN THE MIXING OF SUPERSONIC JETS **c02**

C. Padova, D. W. Boyer, and W. H. Wurster (Wilson Greatbach Ltd., Buffalo, N.Y.) *In* APL The 14th JANNAF Plume Technol. Meeting, Vol. 1 Nov. 1983 p 107-116 refs (For primary document see N84-22619 13-20)

(Contract F04611-80-C-0011)

Avail: NTIS HC A07/MF A01 CSCL 01A

The results presented describe the turbulent mixing of coaxial supersonic jets for a variety of relative Mach numbers and density ratios. Jet Mach numbers of 2, 3 and 4 were obtained with interchangeable nozzles and a supply apparatus housed within the large-scale Calspan Ludwig Tube wind tunnel. The jets were discharged either into an outer stream having a Mach number of 2 or into a quiescent ambient. Molecular weight and temperature of the inner jets were varied to provide ambient-to-jet density ratios ranging from 0.6 to 10. Detailed measurements of pressure, temperature and gas composition obtained at various axial distances from the exhaust plane were used to describe the trends in the supersonic mixing behavior when jet density and Mach number are varied. Author

N84-22629# Florida Univ., Gainesville. Dept. of Mechanical Engineering.

ULTRAVIOLET OH EMISSIONS IN H2-AIR DIFFUSION FLAMES **c25**

K. M. Pamidimukkala, P. F. Schippnick, D. B. Vaidya, and A. E. S. Green *In* APL The 14th JANNAF Plume Technol. Meeting, Vol. 1 Nov. 1983 p 117-122 refs (For primary document see N84-22619 13-20)

Avail: NTIS HC A07/MF A01 CSCL 21/2

Spatial distribution of OH emissions in the middle ultraviolet are observed in a laboratory hydrogen-air diffusion flame using a high resolution spectrometer in combination with a 512 channel diode array detector. Temperature measurements are made using a thermocouple. Using current reaction rates and diffusion coefficients the spatial dependence of OH and other major species are calculated using a version of the BOAT code, which was adapted for subsonic flow. The experimental observations are compared with these predictions. By using both experiment and theory the major features of a laboratory hydrogen-air diffusion flame are modeled. This combination of techniques is also applicable to methane-air diffusion flames. Author

N84-22630# Chemical Dynamics Corp., Columbus, Ohio.

THEORETICAL PREDICTIONS OF EXCITATION CROSS SECTIONS FOR COLLISIONS OF HF, HCl, CO, H2O, AND CO2 WITH O(P-3)

N. J. Redmon, B. C. Garett, and L. T. Redmon *In* APL The 14th JANNAF Plume Technol. Meeting, Vol. 1 Nov. 1983 p 123-129 refs (For primary document see N84-22619 13-20)

(Contract F04611-82-C-0041)

Avail: NTIS HC A07/MF A01 CSCL 21/8

The methodology of modern theoretical chemistry is applied to the prediction of excitation cross sections for a variety of plume species colliding with atomic oxygen. The relative velocity range considered is 40 to 10 km/sec. Reported cross sections generally rise to value of from several tenths to several angstroms at the highest velocities. Although accurate predictions of the cross sections are generally obtained for transitions involving only small changes of vibrational quantum number, estimates are available for cross sections for many energetically accessible processes. Author

N84-22631*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

CATHODE DEGRADATION AND EROSION IN HIGH PRESSURE ARC DISCHARGES

Terry L. Hardy and Shigeo Nakanishi 1983 22 p refs Proposed for presentation at the 17th Ann. Intern. Elec. Propulsion Conf., Tokyo, 28-31 May 1984; sponsored by AIAA

(NASA-TM-83638; E-2000; NAS 1.15:83638) Avail: NTIS HC A02/MF A01 CSCL 21C

The various processes which control cathode erosion and degradation were identified and evaluated. A direct current arc discharge was established between electrodes in a pressure-controlled gas flow environment. The cathode holder was designed for easy testing of various cathode materials. The anode was a water cooled copper collector electrode. The arc was powered by a dc power supply with current and voltage regulated cross-over control. Nitrogen and argon were used as propellants and the materials used were two percent thoriated tungsten, barium oxide impregnated porous tungsten, pure tungsten and lanthanum hexaboride. The configurations used were cylindrical solid rods, wire bundles supported by hollow molybdenum tubes, cylindrical hollow tubes, and hollow cathodes of the type used in ion thrusters. The results of the mass loss tests in nitrogen indicated that pure tungsten eroded at a rate more than 10 times faster than the rates of the impregnated tungsten materials. It was found that oxygen impurities of less than 0.5 percent in the nitrogen increased the mass loss rate by a factor of 4 over high purity nitrogen. At power levels less than 1 kW, cathode size and current level did not significantly affect the mass loss rate. The hollow cathode was found to be operable in argon and in nitrogen only at pressures below 400 and 200 torr, respectively. M.A.C.

N84-22632# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md. Chemical Propulsion Information Agency.
THE 20TH JANNAF COMBUSTION MEETING, VOLUME 1
Debra Sue Eggleston, ed. Oct. 1983 725 p refs Meeting held in Monterey, Calif., 17-20 Oct. 1983 3 Vol.
(Contract N00024-83-C-5301)
(AD-A138033; CPIA-Publ-383-Vol-1) Avail: NTIS HC A99/MF A01 CSCL 21/8

A collection of 62 unclassified/unclassified papers were presented which discussed the following subjects: advanced diagnostic techniques; new burning rate measurement techniques; combustion instability in solid rocket moters and liquid-fueled ramjets; steady-state combustion of composite propellants; metal combustion; interior ballistics of stick and bag charges; ignition characterization of nitramine, double-base, and liquid gun propellants; nitramine kinetics and combustion; supersonic combustion; solid-fuel ramjet combustion; and ignition of low thrust liquid rocket engines. For individual titles, see N84-22633 through N84-22692.

N84-22633# Spectron Development Labs., Inc., Costa Mesa, Calif.
TEMPERATURE, CONCENTRATION, AND SIZE MEASUREMENTS IN TURBULENT REACTIVE FLOWS **c34**
M. Azzazy and J. Craig *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 1-16 refs (For primary document see N84-22632 13-20)
(Contract DE-AC22-80PC-30300; Grant NSF DMR-82-60638)
Avail: NTIS HC A99/MF A01 CSCL 20/4

Three optical diagnostic techniques to measure the surface temperature solid particles, the gas phase temperature and species concentrations, and the size distribution of submicron solid particles were eveloped. The techniques used are: two-line pyrometry, resonant interferometry, and angular intensity ratio. The two-line pyrometer compares the measured ratio of emissive power at two adjacent wavelengths, with the calculated ratio for Plank's radiation law using the temperature as the free parameter. Resonant interferometry involves the selective excitation of one of the absorption lines of the species of interest and holographic recording of the phase distortion and amplitude attenuation of the incident laser beam. The phase shift and absorption measurements are convoluted to yield the temperature and concentration profiles using the dispersion ralations. The angular intensity ratio technique involves comparing the measured ratio of scattered light intensity from solid particles at different angles, with the calculated ratios using Mie scattering theory, with the particle size as the fitting parameters. Author

N84-22634# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
PARTICLE SIZING IN A FUEL RICH AIRBREATHING ENGINE COMBUSTOR
R. Turner and R. E. Lee *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 17-26 refs (For primary document see N84-22632 13-20)
(Contract N00024-83-C-5301)
Avail: NTIS HC A99/MF A01 CSCL 20/8

A laser Doppler anemometer (LDA), configured to measure the size and speed of individual particles, 3 to approximately 100 micrometers in diameter moving at speeds of 528 to 1400 m/s, was used to study the exhaust jet of a fuel-rich ramjet combustor. The LDA appeared suitable for measuring solid particles or small drops. When particle distortion or break-up is a possibility, which is the case in the present application, care in interpreting the results is necessary. The jet flow contained a small number of large particles moving at high speed. The average size of these large particles derived from the visibility and intensity of the LDA signal was approximately 50 micrometers; while their size derived from the particle velocity-lag was approximately 5 microns. The difference between the two measurements is attributed to the clustering of small drops, resulting from the break-up of the large fuel drops, whole size was not resolved by the LDA as instrumented. Author

N84-22635# TRW Space Technology Labs., Redondo Beach, Calif.
THREE-COLOR PYROMETER FOR BURNING PARTICLE TEMPERATURE MEASUREMENT **c35**
N. Gat, L. M. Cohen, and A. B. Witte *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 27-34 refs (For primary document see N84-22632 13-20)
(Contract DE-AC22-81PC-40273)
Avail: NTIS HC A99/MF A01 CSCL 14/2

A custom made three-color pyrometer was utilized to measure the temperature of pulverized coal particles heated, in an inert gas environment, by a high energy HF laser beam. The pyrometer operates in the near IR portion of the spectrum, and has a spatial resolution of about 1 mm. Particle temperature and surface area are obtained by correlating the measurements with Planck's spectral distribution of emission. Particle temperature in the range of 1500 to 2700 K were measured, heating rates were 10(5) to 10(6) K/sec for particles of 63 to 75 microns in diameter. The time resolved temperature-history of the particles, together with the chemical compositon before and after the process, was applied for the derivation of pyrolysis kinetics rate parameters. Author

N84-22636# Army Armament Munitions and Chemical Command, Dover, N.J.
THEORETICAL CALCULATION OF H/SUB 2 S- AND Q-BRANCH SPECTRA FOR PROPELLANT FLAMES **c25**
Joanne Fendell, L. E. Harris, and Kenneth Aron (Geo-Centers, Inc.) *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 35-42 refs (For primary document see N84-22632 13-20)
Avail: NTIS HC A99/MF A01 CSCL 21/2

High energy pure rotational H2 CARS transitions were recently observed in several spectral regions, including the NO and CO CARS regions. H2 CARS is of interest because hydrogen is a major combustion product of propellants, especially nitramine propellants. For this reason, calculations were performed in an effort to assign the observed H2 transitions. For this particular case, the calculations of interest are for the observed S- and Q-branch transitions of H2 for v equal to 0 and 1. Spectroscopic constants available in the literature and the results of an ab initio calculation by Ermler were used in the analysis. Having assigned the transitions, it is possible to calculate the third order susceptibility, which gives a model for data reduction of CARS spectra. By comparison of the theoretical spectra with experimental results, it is possible to obtain temperature and concentration for a given species. Author

N84-22637# Stanford Univ., Calif. High Temperature Gasdynamics Lab.
ADVANCED DIAGNOSTICS FOR REACTING FLOWS **c34**
R. K. Hanson, G. Kychakoff, E. C. Rea, Jr., R. D. Howe, and M. A. Kimball-Linne *In* APL The 20th JANNAF Combust. Meeting,

Vol. 1 Oct. 1983 p 43-50 refs (For primary document see N84-22632 13-20)
(Contract F49620-83-K-0004)
Avail: NTIS HC A99/MF A01 CSCL 20/4

Increasing demands on combustion systems and rapid advances in instrumentation technology have stimulated considerable activity aimed at the development of modern, primarily laser-based diagnostics for combustion research. Several elements of an AFOSR-sponsored program at Stanford on advanced diagnostic techniques for reacting flows are overviewed. Methods to be discussed include: fiber optic absorption/fluorescence probes, wavelength modulation spectroscopy (using tunable IR diode lasers and tunable UV ring dye lasers) and planar laser-induced fluorescence for multiple-point visualization of species concentrations and velocity. Author

N84-22638# Purdue Univ., Lafayette, Ind. School of Aeronautics and Astronautics.
AN OPTICAL SURFACE TRACKING DEVICE WHICH DETERMINES A SOLID PROPELLANT'S BURNING RATE c28
R. A. Frederick, Jr., J. C. Matson, and A. R. Weston (AFRPL) *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 51-60 refs (For primary document see N84-22632 13-20)
Avail: NTIS HC A99/MF A01 CSCL 21/9

A non-intrusive optical sensor capable of continuously measuring the local burning rate of a solid propellant strand under stable ambient conditions was developed. Such an instrument, called a Laser Position Detector (LPD) was designed, analyzed and tested. The LPD detects the distance between a small reflected laser spot (0.67 mm in diameter) on the propellant surface and an optical sensor by utilizing laser beam scanning, geometric height sensing, phase-lock amplifying, and integral feedback tracking. The LPD was evaluated on known inputs and propellant strands. Experiments with mechanically driven surfaces revealed tracking range of 1.5 cm, a resolution of .01 mm, and frequency response to oscillations below 5.0 Hz. The local burning rates of both aluminized and non-aluminized AP propellant strands were measured at atmospheric pressure. The LPD measures the actual propellant surface height through the hostile environment above the propellant surface. The potential capabilities of the LPD were determined by modeling the system. Responses to low frequency burn rate oscillations were determined for the demonstrated system and some improved designs. The device has the capability to measure the average burn rate, and local burn rate fluctuations. Author

N84-22639# Purdue Univ., Lafayette, Ind. School of Aeronautics and Astronautics.
INSITU MEASUREMENT OF BURNING RATE c25
R. L. Glick, H. Pressley, and M. Bielak *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 61-70 refs (For primary document see N84-22632 13-20)
(Contract AFOSR-NTP-0638)
Avail: NTIS HC A99/MF A01 CSCL 21/2

Measurement of local, short time mean burning rates in operating solid rocket motors is considered from systems viewpoints based on radiography and magnetic velocimetry respectively. Radiographic experiments with inert specimens to explore film/screen combinations and technique are described; a difference technique with measuration accuracy of + or - 5 mils was demonstrated so that + or - 0% accuracy is obtained every 50 mils of burnback. Accuracy of the magnetic velocimetry approach is considered and it is shown that velocimeter accuracies commensurate with + or -6% rate errors are possible. Author

N84-22640# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Mechanical Engineering.
MEASUREMENT OF SOLID PROPELLANT BURNING RATES EMPLOYING MICROWAVE TECHNIQUES c25
H. L. Wood, W. F. OBrien, Jr., and C. B. Dale (Naval Ordnance Station) *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 71-80 refs (For primary document see N84-22632 13-20)
(Contract N00174-81-C-0039)
Avail: NTIS HC A99/MF A01 CSCL 21/2

A microwave system for the measurement of solid propellant burning rates is described. A novel analysis is developed for the reduction of time-varying data obtained from microwave burning rate measurement devices. Employing the analysis, burning rate measurement results are presented for simulated data, and for actual data obtained from the firing of propellant in a test chamber. The microwave system and data analysis techniques are applicable to the continuous measurement of variable burning rates, such as would be present in erosive burning test devices. Author

N84-22641# Atlantic Research Corp., Gainesville, Va.
COMPUTERIZED STATIC FIRING ANALYSIS TECHNIQUES OF SOLID PROPELLANT ROCKET MOTORS
K. E. Adams and F. W. Jordan *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 81-94 refs (For primary document see N84-22632 13-20)
Avail: NTIS HC A99/MF A01 CSCL 21/8

The Static Firing Analysis (SFA) computer routine is used to determine nozzle throat efficiency, thrust efficiency, impulse efficiency, burn rates, and the grain surface behavior of a small solid propellant rocket engine. Analysis showed design inadequacies in nozzle throat area, drawing web, propellant weight from the drawing, and grain geometry. Sufficient information was obtained about the motor to provide guidance to the program office for correcting the deficiences. M.A.C.

N84-22642# Georgia Inst. of Tech., Atlanta.
ROCKET MOTOR AEROACOUSTICS c71
U. G. Hegde and W. C. Strahle *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 95-106 refs (For primary document see N84-22632 13-20)
Avail: NTIS HC A99/MF A01 CSCL 20/1

Vibration problems in solid propellant rocket motors are investigated. A class of interior flows modelled to simulate flow conditions inside rocket motor cavities is considered. Turbulence generated pressure fluctuations are shown to consist of two components - acoustic and hydrodynamics. The Bernoulli enthalpy theory of aeroacoustics is employed to extract acoustic pressure spectra from experimentally obtained turbulence data and acoustic impedance values at flow boundaries. The effects of turbulence intensities, sidewall acoustic impedance, axial mass blowing distribution, length to diameter ratio of the cavity and different mass flux on the acoustic pressure level are investigated. Typical pressure levels, under rocket motor conditions, are calculated using the A/B model of propellant response. Estimates of the hydrodynamic component of the pressure fluctuation are provided for the case of fully developed turbulent pipe flow terminated by a choked nozzle. Author

N84-22643# United Technologies Corp., San Jose, Calif. Chemical Systems Div.
COUPLING BETWEEN VELOCITY OSCILLATIONS AND SOLID PROPELLANT COMBUSTION c25
R. S. Brown, P. C. Willoughby, and R. Dunlap *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 107-124 refs (For primary document see N84-22632 13-20)
(Contract F49620-81-C-0027)
Avail: NTIS HC A99/MF A01 CSCL 21/2

Experiments were conducted in a cold flow apparatus which simulates the internal flowfield of a solid propellant rocket motor having a cylindrical port. Acoustic velocity disturbances were generated using a rotating valve at the aft end of the simulator. Oscillatory heat fluxes were measured as a function of axial location over a range of frequency and amplitude of the oscillations, as well as the surface Mach number. The data show that the mean flow environment has a strong influence on the oscillatory heat transfer and acoustic velocity. At low acoustic pressure (0.05%) the acoustic velocity oscillations generate oscillatory wall heat fluxes upstream of the time average velocity profile transition, and have no effect on the flux downstream of the velocity profile transition. As the acoustic pressure amplitude increases, the

surface heat flux downstream of the transition begins to respond. The surface heat flux in the transition region only responds at the highest acoustic pressures tested, (0.5%). Single element hot wire anemometer measurements near the head end of the motor show the acoustic velocities in the core are amplified close to the surface. Nonlinear oscillatory velocity behavior is also seen close to the surface in some cases. Downstream of the mean velocity transition, the turbulence is concentrated near the wall and appears to destroy the acoustic velocity disturbances. M.A.C.

N84-22644# Princeton Combustion Research Labs., Inc., N.J.
FLUID-DYNAMICALLY COUPLED SOLID PROPELLANT COMBUSTION INSTABILITY - COLD FLOW SIMULATION **c34**
Moshe Ben-Reuven *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 125-142 refs (For primary document see N84-22632 13-20)
(Contract F49620-81-C-0018)
Avail: NTIS HC A99/MF A01 CSCL 20/4

The near-wall processes in an injected, axisymmetric, viscous flow is examined. Solid propellant rocket instability, in which cold flow simulation is evaluated as a tool to elucidate possible instability driving mechanisms is studied. One such prominent mechanism seems to be visco-acoustic coupling. The formulation is presented in terms of a singular boundary layer problem, with detail (up to second order) given only to the near wall region. The injection Reynolds number is assumed large, and its inverse square root serves as an appropriate small perturbation quantity. The injected Mach number is also small, and taken of the same order as the aforesaid small quantity. The radial-dependence of the inner solutions up to second order is solved, in polynominal form. This leaves the (x,t) dependence to much simpler partial differential equations. Particular results demonstrate the existence of a first order pressure perturbation, which arises due to the dissipative near wall processes. This pressure and the associated viscous friction coefficient are shown to agree very well with experimental injected flow data. M.A.C.

N84-22645# Purdue Univ., Lafayette, Ind. School of Aeronautics and Astronautics.
ON THE OSCILLATORY FLOWFIELD IN SOLID ROCKET MOTORS
Robert L. Glick and John P. Renie *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 143-160 refs (For primary document see N84-22632 13-20)
(Contract AFOSR-NTP-0638)
Avail: NTIS HC A99/MF A01 CSCL 21/8

A linear analysis of the near wall region was conducted. The phase between all shear and areal mean velocity oscillations is not zero (as assumed in most velocity coupling models) but on the order of PI/2. Pressure and velocity coupling influence that phase relation in a length dependent fashion. An analysis of the incompressible, two-dimensional, nonsteady flowfield in the vicinity of the velocity antimode was conducted for transpired ducts and transpired ducts with resonance rods. The spatial extent of the nonsteady flowfield was roughly invariant with frequency for reasonable injection Reynolds numbers. The presence of a resonance rod markedly increases viscous dissipation of acoustic energy. A methodology for attacking nonsteady turbulent flow is discussed. M.A.C.

N84-22646# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
EFFECT OF OSCILLATIONS UPON VELOCITY DISTRIBUTIONS IN SIMULATED SOLID PROPELLANT FLOW ENVIRONMENTS **c28**
F. L. Chen (NPU), B. R. Daniel, and B. T. Zinn *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 161-168 refs (For primary document see N84-22632 13-20)
(Contract F49620-82-C-0013)
Avail: NTIS HC A99/MF A01 CSCL 21/9

A hot wire is used to investigate the effect of acoustic oscillations upon the radial distribution of the velocity in a tube simulating the flow conditions in solid propellant rocket motors. While the data indicates that the presence of oscillations may strongly influence the velocity field near the wall, where mass addition occurs, there also indications that the measured hot wire velocities are in error in flow regions where the magnitudes of the steady velocity components are of the same order as the magnitudes of the oscillatory velocity components. Utmost caution should be exercised in the interpretation of these data, especially in the wall region where the largest errors in the hot wire measurements most likely occur. M.A.C.

N84-22647# Alabama Univ., Huntsville. Dept. of Mechanical Engineering.
THREE-DIMENSIONAL VORTICITY PROCEDURE INTERACTIONS IN COMBUSTION INSTABILITY ANALYSIS OF SOLID PROPELLANT ROCKET MOTORS
T. J. Chung, R. M. Hackett, S. C. Chan, K. J. Moon, and J. L. Sohn *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 169-180 refs Sponsored in part by AFOSR and U.S. Army NICOM (For primary document see N84-22632 13-20)
Avail: NTIS HC A99/MF A01 CSCL 21/8

The governing equations for interactions between acoustic and vortical components of the flow field and relevant applications are included. It is shown that finite element models are convenient for calculations of the flow field to predict separation of flow and shear layers which will then be used in the stability integral. These expressions which are responsble for interactions of acoustic and vortical oscillations are evaluated through simple example problems. M.A.C.

N84-22648# Utah Univ., Salt Lake City.
GENERATION OF VEHICLE WOBBLING BY THE UNSTEADY FLOW FIELD IN A SPINNING SOLID PROPELLANT ROCKET MOTOR
Gary A. Flandro *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 181-192 refs (For primary document see N84-22632 13-20)
(Contract F04611-83-K-0047)
Avail: NTIS HC A99/MF A01 CSCL 21/8

Coning or wobbling motions which pose a potentially serious mission performance problem are observed late in motor operation in a variety of spacecraft which employ the same upper stage solid propellant propulsion module. A self consistent theoretical model for the observed coning motion based on unsteady gas dynamics of the combustion products and their interaction with vehicle motion are described. A classical phenomenon know as interial waves or elastoid inertial waves is implicated. An important element in the instability is the presence of an intense axial vortex which is produced in the gas flow by the spin. Compelling support for this model is the resonance coincidence of the inertial wave motions with the natural free precession frequency of the vehicle. Coincidence occurs about halfway through the motor firing, corresponding closely to the time at which coning growth is observed to begin. Methods for avoiding such attitude instabilities are presented. Since the primary energy source for the oscillations is the vehicle spin kinetic energy, reduction of spin rate is the most practical method for reducing the final cone angle without modification of the propulsion system or spacecraft mass distribution. Since the inertial mode frequencies are determined mainly by the combustion chamber shape (and the spin rate), resonance can be avoided at the design stage by proper attention to propellant configuration. M.A.C.

N84-22649# Pennsylvania State Univ., University Park. Dept. of Aerospace Engineering.
DIRECT MEASUREMENT OF HIGH FREQUENCY SOLID PROPELLANT RESPONSE FUNCTIONS **c28**
J. R. Wilson and M. M. Micci *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 193-202 refs (For primary document see N84-22632 13-20)
(Contract F04611-82-K-0063)
Avail: NTIS HC A99/MF A01 CSCL 21/9

The preliminary research on a system that is theoretically capable of directly measuring the propellant pressure-coupled

admittance at the high frequencies associated with tangential mode instabilities is presented. The system utilizes a magnetic flowmeter to measure the velocity oscillation above a burning propellant surface within an externally excited combustion chamber. Correlation of the oscillatory pressure yields the acoustic admittance. Extensive cold flow simulation has indicated that a proposed design for the magnetic flowmeter burner is capable of producing the desired pressure perturbations. A theoretical analysis is developed to model and predict the propellant pressure-coupled response functions to be measured in the experimental apparatus. Efforts are also underway to calibrate the magnetic flowmeter burner.
M.A.C.

N84-22650# Morton Thiokol, Brigham City, Utah.
ACOUSTIC AND PHOTOELECTRIC BURNOUT DETECTION OF T-BURNER GRAINS **c28**
D. P. Clark and T. D. Moore *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 203-206 (For primary document see N84-22632 13-20)
Avail: NTIS HC A99/MF A01 CSCL 21/9

Acoustic and photoelectric transducers were used to detect the time of burnout of T-burner propellant grains. The output of these transducers was used, after electronic processing, to trigger an end of burn pulse in the T-burner. A variety of composite and nitramine propellant were tested this method of automatic after burning pulse triggering looks very promising. Examples of acoustic and optical detector traces are presented and successes to date and problems remaining are discussed. E.A.K.

N84-22651# Naval Weapons Center, China Lake, Calif.
ANALYSIS OF ACOUSTIC CHAMBER PRESSURE OSCILLATIONS IN SHUTTLE HIGH-PRESSURE SRB'S
H. B. Mathes *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 207-214 refs (For primary document see N84-22632 13-20)
Avail: NTIS HC A99/MF A01 CSCL 21/8

Acoustic stability predictions that were performed for the shuttle solid rocket booster (SRB), are reviewed. Motor test data from static testing of standard SRB motor designs are summarized. Test data from high performance SRB's with resuls from seven SRB's of standard design are compared. E.A.K.

N84-22652# Naval Ordnance Station, Indian Head, Md.
TANGENTIAL MODE INSTABILITY IN DOUBLE-BASE SOLID ROCKET MOTORS: A CASE STUDY
R. E. Kaczmarek *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 215-222 refs (For primary document see N84-22632 13-20)
Avail: NTIS HC A99/MF A01 CSCL 21/8

Rocket motor were tested in which the motor configuration was systematically changed to allow for design improvement to correct combustion instability. The varied parameters included nozzle throat diameter, symmetry number of star points in the grain perforation, addition of potassium salts into the combustion gases, and the placement of resonance rods and baffles in the free volume of the grain perforation. It was found that the geometry of the grain perforation has a major influence on the tangential mode instability. It was shown that a grain design with an odd number of star points significantly mitigates the influence of the oscillations when compared to the effect of even point design. After initial tests with the odd-point star design, the design was refined not to degrade the design. The odd point design, however, still suffered from tangential mode instability. It is found that the instability could effectively be eliminated by the addition of a baffle placed in the perforation of the odd point star grain design.
E.A.K.

N84-22653# Georgia Inst. of Tech., Atlanta.
DEPENDENCE OF BURNING RATE OF AP-POLYMER SANDWICHES ON THICKNESS OF THE BINDER LAMINAE **c28**
Edward W. Price and Jayaraman K. Sambamurthi *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 223-234 refs (For primary document see N84-22632 13-20)
(Contract N00014-79-C-0764)
Avail: NTIS HC A99/MF A01 CSCL 21/9

The burning rate of AP-PBAN-AP sandwiches was measured for a range of binder thicknesses from 25 - 175 micrometer for pressures of 1.38, 2.10, 3.45 and 5.52 MPa. A maximum rate for each pressure at a binder thickness of 65 to 100 micrometer is shown. The trend in rate with binder thickness and pressure is combined with observations of burning surface profiles and combustion limits, to show how the combustion zone microstructure changes with test sample microstructure and combustion pressure. E.A.K.

N84-22654# Purdue Univ., Lafayette, Ind. School of Aeronautics and Astronautics.
EFFECT OF NON-CONSTANT SOLID PHASE THERMAL PROPERTIES ON TEMPERATURE SENSITIVITY OF SOLID PROPELLANT **c28**
J. P. Renie, M. S. Geyer, and J. R. Osborn *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 235-238 refs Sponsored in part by Morton Thiokol, Inc. (For primary document see N84-22632 13-20)
Avail: NTIS HC A99/MF A01 CSCL 21/9

A numerical scheme was employed within the Petite Ensemble Model (PEM) to calculate the steady state temperature profile within the solid phase of an AP-based, composite propellant. The solid phase energy equation is nonlinear which is due to the dependency of the thermal properties of specific heat and thermal conductivity on local temperature. It is assumed that exothermic decomposition reactions can take place within the solid phase of the propellant. The magnitude of the subsurface energy store/heat release can be calculated along with the value of the temperature gradient at the propellant surface solid/gas interface. Thermal property data for typical propellant ingredients indicate that thermal diffusivity decreases with increasing temperature. Solid phase thermal profiles for a series of propellants show an increase in the thermal wave thickness with a decrease in propellant burn rate which results in an increase in the temperature sensitivity parameter. Increased temperature sensitivity with increased oxidizer particle size, or decreased propellant burning rate are indicated. E.A.K.

N84-22655# Aberdeen Proving Ground, Md.
STATUS OF AMMONIUM NITRATE IN PROPELLANTS AND EXPLOSIVES **c28**
Indu B. Mishra (Olin Corp.), Russell Reed (Naval Weapons Center), Eugene Pacanowsky, and Larry VandeKieft *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 239-262 (For primary document see N84-22632 13-20)
Avail: NTIS HC A99/MF A01 CSCL 21/9

Explosives and propellants usng ammonium nitrate, with emphasis on deficiencies are summarized. It is found that ammonium nitrate is suitable for use, yet the polymer binder may give a better bonding. It is concluded that both propellants and explosives are very useful for present and future application.
E.A.K.

N84-22656# Princeton Combustion Research Labs., Inc., N.J.
ASYMPTOTIC CONDENSED PHASE ANALYSIS OF DEFLAGRATING MONOPROPELLANTS WITH SUBSURFACE EXOTHERMICITY **c28**
Moshe Ben-Reuven *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 263-280 refs (For primary document see N84-22632 13-20)
(Contracts AFOSR-MIPR-81-0004; DAAK11-80-C-0104)
Avail: NTIS HC A99/MF A01 CSCL 21/9

The role of subsurface decomposition in the overall deflagration process and explicit algebraic formulation were studied. A singular perturbation problem of the boundary layer type is formulated, with the ratio of R sub T s/Ec as the appropriate small quantity. The total enthalpy flux, the extent of subsurface reaction, and the condensed phase space coordinate, up to second order are outlined. Inner/outer matching yields an expression for the first order eigenvalue perturbation. A small positive burning rate

increment is indicated, relative to a zeroth order pyrolysis law, due to subsurface exothermicity. The T sub s sensitivity of all the variables of interest is shown. E.A.K.

N84-22657# Naval Weapons Center, China Lake, Calif.
CONDENSED PHASE TEMPERATURE PROFILES IN DEFLAGRATING HMX c28
D. M. Parr and T. P. Parr *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 281-292 refs (For primary document see N84-22632 13-20)
Avail: NTIS HC A99/MF A01 CSCL 21/9

A bulk observable for HMX deflagration: the condensed phase temperature profile and burning surface temperature was measured. Modeling of HMX monopropellant deflagration was constrained only by matching experimental measurements of the burning rate as a function of pressure or pressure and initial sample temperature. Different model assumptions can produce the same pressure dependent burn rate. Even with the added constraint of a measured temperature sensitivity, reasonable fits to the data can be obtained with a range of input parameters. To fit a single bulk observable does not validate the chemistry, energetics, and/or kinetics used in the model. Detailed in situ measurements of flame intermediate specie concentrations, standoff structure, and temperature profile and condensed phase morphology, decomposition species, and temperature profile are needed to fully understand the deflagration process. A simple measurement of another bulk observable would contribute to the constraint of the model fitting process and give increased confidence of the energetic and kinetic parameters. E.A.K.

N84-22658# Hercules, Inc., Magna, Utah. Aerospace Div.
A SUMMARY OF THE MECHANISMS OF DELAYED DETONATION c25
A. G. Butcher, K. P. McCarty, R. L. Keefe, and E. J. Blommer *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 293-318 refs (For primary document see N84-22632 13-20)
(Contract N00030-C-82-C0101)
Avail: NTIS HC A99/MF A01 CSCL 21/2

Types of delayed detonation phenomena were studied. These studies are directed primarily to events preceding detonation as opposed to events after shock formation has occurred. The types of detonation transition investigated are deflagration to detonation transition, DDT, and impact initiated delayed detonation, XDT. The work on both subjects DDT and XDT which shows similarities in the basic behavior of delayed detonation is summarized. Results from XDT and DDT are quoted and ties these results together with respect to the basic mechanisms leading to transition. E.A.K.

N84-22659# Naval Postgraduate School, Monterey, Calif.
AN INVESTIGATION OF EXPERIMENTAL TECHNIQUES FOR OBTAINING PARTICULATE BEHAVIOR IN METALLIZED SOLID PROPELLANT COMBUSTION c28
R. G. Cramer, R. J. Edington, D. E. Faber, K. J. Graham, B. J. Hansen, P. J. Hickey, L. A. Klooster, P. J. Mellin, J. P. Powers, and D. W. Metzer *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 319-332 refs (For primary document see N84-22632 13-20)
(Contracts F04611-82-X-0008; F04611-83-X-0010)
Avail: NTIS HC A99/MF A01 CSCL 21/9

A continuing investigation is being conducted to obtain quantitative data that can be used to relate propellant composition and operating environment to the behavior of solid particulate within the grain port and exhaust nozzle. The techniques employed are monochromatic high-speed motion pictures of strand burners and slab burners in a cross-flow environment, SEM analysis of post-fire residue (strand, slab, and motor), determination of D(32) across the exhaust nozzle using measurements of scattered laser light, holograms of burning propellant strands and slabs in a cross-flow environment, and automated retrieval of particle data from holograms. Progress and data examples for each technique are presented. Author

N84-22660# Georgia Inst. of Tech., Atlanta.
CONDITIONS FOR INFLAMMATION OF ACCUMULATED ALUMINUM IN THE PROPELLANT COMBUSTION ZONE c28
E. W. Price, J. K. Sambamurthi, R. K. Sigman, and T. S. Sheshadri *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 333-342 refs (For primary document see N84-22632 13-20)
(Contract F49620-82-C-0013)
Avail: NTIS HC A99/MF A01 CSCL 21/9

Identification of the conditions necessary for ignition of accumulating aluminum is important for progress in practical design of propellants and for proper modeling of combustion. A variety of experimental results that establish the principal criteria for inflammation of aluminum in the propellant combustion zone (AP-hydrocarbon binder propellants) are summarized. The results indicate that, in situations where aluminum accumulation occurs on the burning surface, inflammation occurs at sites of exposure to the high temperature flame between oxidizer and binder vapors. Under particularly unfavorable conditions for ignition (e.g., low pressure), inflammation is sometimes aided by break-up of aluminum aggregates due to flow forces. Ignition is not precipitated by simple exposure to oxidizer vapors, by attainment of the metal melting point, or by simple emergence of the particle from the binder. M.G.

N84-22661# Morton Thiokol, Brigham City, Utah.
COMBUSTION OF HIGH-ALUMINUM-CONTENT PROPELLANTS c28
Winston N. Brundige *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 343-350 refs (For primary document see N84-22632 13-20)
Avail: NTIS HC A99/MF A01 CSCL 21/9

Techniques were evaluated for improving the combustion efficiency of low-burn-rate, 24- and 26-percent aluminum (Al) propellants by providing optimum ammonium perchlorate (AP) particle size distributions and by using a particle isolation additive. Combustion bomb and subscale motor tests showed that Al combustion was improved; however, decreases in agglomeration and particle size in the combustion zone near the burning propellant surface did not result in changes in two-phase flow nozzle losses or increases in delivered specific impulse I(sp) efficiency. The efficiencies achieved did result in superior predicted performance for volume-limited, I(sp)-density-critical applications. M.G.

N84-22662# Gough (Paul) Associates, Inc., Portsmouth, N.H.
CONTINUUM MODELING OF STICK CHARGE COMBUSTION c25
Paul S. Gough *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 351-364 refs (For primary document see N84-22632 13-20)
(Contracts N00174-80-C-0316; DAAK11-82-C-0053)
Avail: NTIS HC A99/MF A01 CSCL 21/2

The representation of the macroscopic combustion processes in stick propellant charges according to the general two-phase formulation previously developed in connection with granular charges is discussed. The derivation and interpretation of the macroscopic balance equations are reviewed and the constitutive laws for stick propelling charges are contrasted with those used previously for granular charges. Both one-dimensional and two-dimensional models are discussed although emphasis is given to the former. One-dimensional solutions of the governing equations for stick propellant are obtained by the method of finite differences using using the NOVA code. These solutions distinguish between the exterior and the interior properties of perforated sticks. Gas-phase properties within the perforations are assumed to differ in all respects from those in the interstices. In addition, distinct ignition histories and rates of surface regression are modeled on the exterior and interior surfaces. Two-dimensional solutions are obtained using the TDNOVA code. The latter model incorporates all the features of the one-dimensional model and further includes a representation of slotted stick combustion and the interactions between the propellant combustion and the structural and thermochemical properties of the increment containers. M.G.

N84-22663# Gough (Paul) Associates, Inc., Portsmouth, N.H.
MULTI-DIMENSIONAL, MULTIPHASE FLOW ANALYSIS OF FLAMESPREADING IN A STICK PROPELLANT CHARGE c34
A. W. Horst (Ballistic Research Lab.), F. W. Robbins (Ballistic Research Lab.), and P. S. Gough *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 365-376 refs (For primary document see N84-22632 13-20)
Avail: NTIS HC A99/MF A01 CSCL 20/4

The interior ballistic performance of propelling charges employing stick propellant often cannot be simulated using either lumped parameter or two phase flow models. Much of this disparity is usually attributed to enhanced burning within the long perforations, perhaps accompanied by splitting or fracture of the stick to yield additional burning surface. Unusually low (or even reversed) sensitivity of performance to propellant conditioning temperature has also been noted, a factor that, if controllable, may have significant impact on the acceptability of new stick propellant charges. Moreover, the mechanisms responsible for all the above behavior may well be exploitable as high progressivity, high density (HPD) propelling charge concepts. A state of the art version of TDNOVA, a two dimensional, two phase flow interior ballistic code, is employed to probe the ignition and flamespreading processes in stick propellant charges. Calculations of flame propagation on exterior and interior surfaces, as well as pressurization profiles both within the perforations and in the interstices, are described for typical and simplified stick charge configurations. Reconcilation of predicted behavior with experimental observation is discussed, and further specific studies using TDNOVA are identified in order to verify a postulated explanation for ballistic data exhibiting an anomalous temperature sensitivity. M.G.

N84-22664# Ballistic Research Labs., Aberdeen Proving Ground, Md.
SLOTTED STICK PROPELLANT STUDY c28
F. W. Robbins and A. W. Horst *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 377-386 refs (For primary document see N84-22632 13-20)
Avail: NTIS HC A99/MF A01 CSCL 21/9

While classical, lumped parameter modeling of granular propellant gun firings is often quite successful at reproducing experimental data, a similar treatment of stick propellant firings typically yields somewhat lower pressures and muzzle velocities than actually experienced in the gun. To identify those processes responsible for this behavior, a set of highly instrumented gun firings was performed in a 155-mm howitzer, using both stick and granular propellant charges. To simplify the investigation as well as to facilitate the analysis, a slotted, single perforated stick propellant was employed, and the granular propellant was prepared simply by cutting some of the sticks to a shorter length. Firings of the two types of charges yielded the name muzzle velocities, but with the stick charges operating at a 4% lower maximum chamber pressure. Detailed analysis of pressure versus time and travel profiles, obtained using fixed and onboard pressure instrumentation, along with concurrent multiphase flow (NOVA) simulations of the event, suggest two major contributors to the unexpected performance of the stick propellant charges. The first is an artificial progressivity resulting from higher post-peak chamber pressures associated with the more localized burning of the stick propellant. The second is a hydrodynamic effect resulting from the non-Lagrangian pressure and velocity profiles exhibited by a stick propellant charge. M.G.

N84-22665# Army Armament Munitions and Chemical Command, Dover, N.J.
CLOSED VESSEL COMBUSTION STUDIES OF STICK PROPELLANT c28
Donald Chiu, Aaron Grabowskiy, and David Downs *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 393-402 refs (For primary document see N84-22632 13-20)
Avail: NTIS HC A99/MF A01 CSCL 21/9

Combustion of slotted single perforated stick, triple base M31 type propellant was studied in a closed environment. The primary objective of these studies was to provide information for the characterization of stick propellants. Burning rates were determined as a function of propellant stick lengths, igniter configurations and closed bombs with different length to diameter ratios. Low pressure burning rates were obtained from strand tests to eliminate possible variability in the extrapolation from the burning rate curve obtained from closed bombs. Studies of changes in the effective burning surface area of the propellant were performed in terms of vivacity. Orientation of the propellant sticks appeared to change the initial vivacity values or the effective burning surface area. With random orientation of the propellant sticks, burning rates obtained were higher than these obtained from the stacked orientation. This may due to change in the ignition gas flow patterns over the propellant bed. Author

N84-22666# Ballistic Research Labs., Aberdeen Proving Ground, Md.
FLASH X-RAY WITH IMAGE ENHANCEMENT APPLIED TO COMBUSTION EVENTS c35
K. J. White and D. G. McCoy *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 415-426 refs (For primary document see N84-22632 13-20)
Avail: NTIS HC A99/MF A01 CSCL 14/2

Flow visualization of interior ballistic processes by use of X-rays has placed more stringent requirements on flash X-ray techniques. The problem of improving radiographic contrast of propellants in X-ray transparent chambers was studied by devising techniques for evaluating, measuring and reducing the effects of scattering from both the test object and structures in the test area. X-ray film and processing is reviewed and techniques for evaluating and calibrating these are outlined. Finally, after X-ray techniques were optimized, the application of image enhancement processing which can improve image quality is described. This technique was applied to X-ray studies of the combustion of very high burning rate (VHBR) propellants and stick propellant charges. M.G.

N84-22667# Ballistic Research Labs., Aberdeen Proving Ground, Md.
CLOSED BOMB COMBUSTION SIMULATION OF HIVELITE SOLID PROPELLANT c28
Douglas E. Kooker and Ronald D. Anderson *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 427-446 refs (For primary document see N84-22632 13-20)
Avail: NTIS HC A99/MF A01 CSCL 21/9

The traveling-charge gun-propulsion concept requires solid propellant capable of liner buring rates in excess of 100 m/s. A potential candidate is the family of Hivelite Propellants (trade-name of Teledyne McCormick Selph). It is proposed that a stress-induced break-up mechanism will explain data obtained previously in closed-bomb combustion experiments (BRL). This mechanism is the basis for a mathematical model to simulate combustion in a closed bomb. The rate-dependent constitutive behavior assigned to the propellant is guided by results from recent mechanical property tests on two Hivelite formulations. Comparison of the experimental closed-bomb pressure-time history to theoretical predictions from the new model is encouraging. Author

N84-22668# Ballistic Research Labs., Aberdeen Proving Ground, Md.
EFFECT OF FABRICATION TECHNIQUES ON CONSOLIDATED CHARGE BURNING c28
J. O. Doali, A. A. Juhasz, R. E. Bowman, and W. P. Aungst *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 447-462 refs (For primary document see N84-22632 13-20)
Avail: NTIS HC A99/MF A01 CSCL 21/9

The effect of fabrication techniques upon the burning behavior of consolidated charges was studied. Three sets of propellant (M5) consolidated using different consolidation techniques were subjected to closed bomb firings. Each group of propellant increments (40 mt x 25 mm) were compacted to three densities ranging from 1.10 to 1.39 g/cc. Effective burning rates and surface area profiles were extracted from closed bomb data for comparison. Additionally, interrupted closed bomb burning experiments were

performed in an attempt to detect differences in deconsolidation due to fabrication techniques. The picture which emerges from these studies is that sample deconsolidation is essentially complete at a very early stage (42 to 70 NPa) of the combustion cycle.
R.J.F.

N84-22669# Army Armament Munitions and Chemical Command, Dover, N.J. Fire Control and Small Caliber Weapon Systems Lab.
NEUTRON RADIOGRAPHIC STUDY OF LIQUID PROPELLANT COMBUSTION c25
Michael P. Devine and Bruce W. Brodman *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 463-472 Prepared in cooperation with Oregon State Univ., Corvallis and GE, Burlington, Vt. (For primary document see N84-22632 13-20)
(Contracts DAAK10-78-C-0323; DAAK10-79-C-0221)
Avail: NTIS HC A99/MF A01 CSCL 21/2

The technique of high speed neutron radiography is useful for study of liquid propellant motion inside test fixtures during actual firings. This is due to the fact that the neutron cross section of the hydrogen-rich propellants is substantially larger than that of the surrounding metal fixture. In this procedure, an intense pulse of thermal neutrons is passed through a test fixture during firing, the neutrons are scattered (primarily by the liquid inside the fixture) and the modulated beam emerging from the fixture is converted to a light image. The light image is recorded on a high speed camera, thus providing a visual record of propellant motion throughout the firing cycle. High speed neutron radiographs were taken of firings of a .35 cal in-line regenerative piston liquid propellant test fixture. The films were subjected to image enhancement and interactive graphics techniques. Data reduced from these films, dealing with propellant jet characteristics, is presented.
R.J.F.

N84-22670# Ballistic Research Labs., Aberdeen Proving Ground, Md.
LIQUID PROPELLANT IGNITION STUDIES c25
Nathan Klein *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 473-482 refs (For primary document see N84-22632 13-20)
Avail: NTIS HC A99/MF A01 CSCL 21/2

Small test fixtures, commonly called plasma plugs, are simple, safe and highly effective devices for studying the ignition characteristics of aqueous, liquid propellants. Since the propellants are water-based mixtures of ionic nitrate salts, they are excellent electrical conductors and the ignition stimulus used is energy, stored in capacitors, and delivered to the samples in carefully controlled and highly reproducible pulses. Two distinct modes of energy transfer are observed. In one, an arc is formed in the air-gap above the sample and the hot pressurized gas thus produced then reacts with the propellant causing ignition. A second energy transfer mode consists of current flow through the sample without arc formation. In this latter mode, reaction in the sample is induced either by ohmic heating or by ion transport, causing a change in composition of the sample in the vicinity of the electrode surfaces that, in turn, leads to reaction. Observation of the plumes venting from the plasma plugs using high-speed shadow and schlieren cinephotography indicates that the reaction sequence obtained is strongly dependent on the energy transfer mode and that the time and space history of these plumes can be controlled both by the method whereby energy is transferred to the sample and by the geometry of the plasma plug. The results have strong implications for the design of an ignition system for a practical liquid propellant gun and for the modelling of ignition phenomena in propellants of this generic type. Author

N84-22671# Applied Combustion Technology, Inc., Orlando, Fla.
EXPANDED IGNITION EFFECTIVENESS TESTS OF SELECTED IGNITER MATERIALS WITH NAVY PROPELLANTS c25
A. Michael Varney, John Martino, and Rod Henry *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 483-492 refs (For primary document see N84-22632 13-20)
(Contract N00174-31-C-0453)
Avail: NTIS HC A99/MF A01 CSCL 21/2

Twenty-one series of Bruceton tests were conducted to evaluate the ignition effectiveness of BP, BKNO3, NC, MTV, BMoO3, and AP igniter materials with NACO, LOVA, WOSOL-318, and PYRO propellants using a high pressure, flow through combustor. Comparisons between experimentally determined data and theoretical calculations are presented herein with test data, analyses, and conclusions. Of the data acquired, the firing results of NACO and LOVA propellants are the most complete. A review of the composite firing data suggests that igniter product gas phase mass fractions on the order of 30-50 percent are essential for propellant ignition at minimum input pressure levels. Further, the results obtained suggest the importance of igniter product liquid phase mass fractions for achieving an in-depth propellant ignition boundary. LOVA fifty percent ignition energy requirements were observed to be 2-3 times greater than observed for NACO propellant. LOVA ignition energy requirements were found to be significantly reduced by the presence of oxidizer rich igniter species (AP). LOVA ignition sensitivity with AP was equivalent to the energy requirements for the easy-to-ignite NACO propellant with conventional materials.
R.J.F.

N84-22672# Ballistic Research Labs., Aberdeen Proving Ground, Md.
CONVECTIVE HEATING OF ENERGETIC MATERIALS c34
Richard A. Beyer and Mark A. DeWilde *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 493-498 refs (For primary document see N84-22632 13-20)
Avail: NTIS HC A99/MF A01 CSCL 20/4

Flow visualization and gas sampling measurements were made with samples of energetic materials in gas flow sufficiently hot to cause pyrolysis, ignition, or full combustion. Pyrolysis gas sampling yields primarily the same gases as conventional heating, with some evidence of further incomplete reactions between HMX products at higher temperatures. Shadowgraph records show evidence of small-scale grain breakup for NOSOL 363, but not for M30, during ignition and combustion. Also noteable was the substantial amount of gas evolution from grain perforations of M30 before ignition.
R.J.F.

N84-22673# Ballistic Research Labs., Aberdeen Proving Ground, Md.
EFFECT OF O2 ON DOUBLE-BASE PROPELLANT IGNITION c25
A. Cohen and H. E. Homes *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 499-504 refs (For primary document see N84-22632 13-20)
Avail: NTIS HC A99/MF A01 CSCL 21/2

Experiments were made in a conventinal shock tube to ignite double-base propellants in the presence of O2 under conductive heating conditions. Due to insufficient test times, the experiments were unsuccessful. It is believed that the required test times can be obtained without major modifications and that the ignition delay dependence on temperature (surface and gas) and O2 can be determined in this facility. A temperature of approximately 900 K and pressure of approximately .15 mPa explosion delays in a lean acetaldehyde/NO2 mixture were decreased by 30% by addition of 5% O2. Larger effects are expected for rich mixtures and may be a mechanism for the acceleration of double-base propellant ignition in the presence of O2.
R.J.F.

N84-22674# Army Research and Development Command, Dover, N.J.
MOLECULAR DYNAMICS OF PROPELLANT GASES c28
T. Vladimiroff *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 505-510 refs (For primary document see N84-22632 13-20)
Avail: NTIS HC A99/MF A01 CSCL 21/9

The technique of molecular dynamics is used to calculate the equation of state for propellant gases at the high temperature and pressure found in large caliber guns. Newton's equations of motion are solved for a system of 256 particles using a periodic boundary condition. A Lennard-Jones potential is assumed to

describe the interaction between particles. A predictor-corrector type of algorithm is employed to integrate the equations of motion which are assumed to be purely classical. Special care is taken to insure that the integration time step is small enough to obtain good conservation of energy. Calculated pressures are compared with the pressures obtained using Verlet-Weis perturbation theory, the Percus-Yevick equation, and the Haar-Shenker equation of state. Good agreement is found for nitrogen at 3000 K for all these techniques. Author

N84-22675# Ballistic Research Labs., Aberdeen Proving Ground, Md.
THE THERMODYNAMICS OF REAL AND UNREAL BLACK POWDER **c28**
Eli Freedman *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 511-518 refs (For primary document see N84-22632 13-20)
Avail: NTIS HC A99/MF A01 CSCL 21/9

Many calculations were made on real black powder (meaning BP in which actual laboratory data was used for the charcoal). The computed maximum pressures and heats of explosion are compared with experiment, and found to be low, not high as might have been expected. These discrepancies are discussed. Some unreal BPs containing well-defined chemical compounds in place of charcoal are discussed, and their computed pressures compared with those of BPs containing charcoal. R.J.F.

N84-22676# Tally Industries, Inc., Mesa, Ariz.
INVESTIGATION OF ORGANIC OXIDIZERS FOR HIGH PERFORMANCE LOW FLAME TEMPERATURE GAS GENERATOR APPLICATIONS **c28**
M. L. Moore, P. H. Graham, and N. H. Lundstrom (Lundstrom Technical Services, Tacoma, Wash.) *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 519-528 refs (For primary document see N84-22632 13-20)
Avail: NTIS HC A99/MF A01 CSCL 21/9

A requirement exists for castable low flame temperature gas generator propellants with higher burning rates and greater performance than state-of-the art ammonium nitrate oxidized systems. The approach taken involved the substitution of organic oxidizers to overcome the disadvantages of ammonium nitrate (i.e. low energy, hygroscopicity, and narrow burning rate regime). The influence of composition on the flame temperature and ballistic properties of organic oxidizer filled systems was investigated. Author

N84-22677# Pennsylvania State Univ., University Park. Dept. of Mechanical Engineering.
NITRAMINE PROPELLANT IGNITION UNDER RAPID GAS LOADING CONDITIONS **c28**
S. Yu, W. H. Hsieh, and K. K. Kuo *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 529-546 refs (For primary document see N84-22632 13-20)
Avail: NTIS HC A99/MF A01 CSCL 21/9

Ignition of nitramine composite propellants located at the tip of an inert crack was investigated both experimentally and theoretically. A theoretical model is proposed for the ignition of nitramine composite propellants. Specific features considered in the model include: (1) detailed chemical kinetics information for the ignition of nitramine composite propellant, (2) two dimensional axisymmetric) geometry for the composite propellant, and (3) rapid pressurization of the gas phase simulating actual rocket motor ignition conditions. The ignition process was also observed by simultaneously using a high-speed movie camera, a fast-response photodiode system, and a near-infrared photodiode system. Many nitramine propellants showed momentary ignition followed by extinction. It is found that the time required for the onset of gas evolution of nitramine propellants decreases as the pressurization rate is increased. Under the same operating conditions, nitramine-based composite propellants are harder to ignite than AP-based propellants. Nitramine propellants with HMX fillers are slightly more difficult to ignite than RDX-based propellants due to higher thermal diffusivity and activation energy for decomposition. Author

N84-22678# Applied Combustion Technology, Inc., Orlando, Fla.
IGNITIBILITY STUDIES OF LOVA PROPELLANTS **c25**
A. Michael Varney, John Martino, and Rod Henry *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 547-556 refs (For primary document see N84-22632 13-20)
(Contract N00174-81-C-0453)
Avail: NTIS HC A99/MF A01 CSCL 21/2

Sixteen series of Bruceton tests were conducted at normal temperature and -20 F soak temperature to evaluate the ignition effectiveness of BP, BKNO3, NC, MTV, BMoO3, and AP igniter materials with LOVA propellant using a high pressure, through combustor. A review of the composite firing data suggests that igniter product gas phase mass fractions on the order of 30 to 50 percent are essential for propellant ignition at minimum input pressure levels. Further, the results suggest the importance of igniter product liquid phase mass fractions for achieving an in-depth propellant ignition boundary. The LOVA 50 percent ignition energy levels were observed to be 2 to 3 times greater than NACO propellant requirements. LOVA ignition energy requirements were found to be significantly reduced by the presence of oxidizer rich species in the igniter. Ignition sensitivity with the oxidizer rich system (AP) was equivalent to the energy requirements for the easy-to-ignite NACO propellant with conventional igniter materials. Author

N84-22679# Ballistic Research Labs., Aberdeen Proving Ground, Md.
MULTIPHASE FLOW ANALYSIS OF THE BALLISTIC PERFORMANCE OF AN ANOMALOUS LOVA PROPELLANT MIX **c28**
Albert W. Horst *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 557-570 refs (For primary document see N84-22632 13-20)
Avail: NTIS HC A99/MF A01 CSCL 21/9

Low-vulnerability (LOVA) gun propellants offer an attractive approach to the reduction of the probability of catastrophic kill of armored weapon systems resulting from the initiation of onboard ammunition. The particular attributes of LOVA propellants which contribute to the desired impact on vulnerability include reduced ignitability and decreased burning rates at low pressures. These same characteristics, however, may influence other aspects of the ballistic cycle, unintended and unexpected by the propellant/charge designer. The interplay of these various features is investigated, specifically in respect to the anomalous ballistic performance of a particular LOVA propellant mix, by means of a two-phase flow interior ballistic code (NOVA). The potential impact on gun performance is discussed. Author

N84-22680# Air Force Rocket Propulsion Lab., Edwards AFB, Calif.
DEUTERIUM ISOTOPE EFFECTS IN HMX THERMOCHEMICAL MECHANISMS: DECOMPOSITION, DEFLAGRATION, AND COMBUSTION **c28**
S. A. Shackelford, M. B. Coolidge, B. B. Goshgarian, R. N. Rogers (LASL), J. L. Janney (LASL), M. H. Ebinger (LASL), D. A. Flanigan (Morton Thiokol, Inc., Huntsville, Ala.), and R. E. Askins (Morton Thiokol, Inc., Huntsville, Ala.) *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 571-580 refs (For primary document see N84-22632 13-20)
Avail: NTIS HC A99/MF A01 CSCL 21/9

Deuterium isotope effects can directly reveal rate-controlling chemical reactions and molecular bond ruptures in real time during the energy releasing event itself. Thermochemical decomposition investigations were conducted with solid HMX several degrees below its melting point. The HMX samples proceeded through three physical states: solid, mixed malt, and liquid. Three distinct deuterium isotope effects were found; each was different in magnitude and type, and each was dependent upon one the three HMX physical states. This suggests a change in mechanism and rate-controlling reaction for each condensed phase cited. Investigations in both rapid pyroprobe deflagration and explosive deflagration revealed a single deuterium isotope effect for each, but each isotope effect was different and infers that rate-controlling reactions depend upon the predominant HMX physical state present during a specific type of thermochemical event. Pressurized glass

tube combustion experiments with HMX and HMX-d8 pellets are currently in progress to identify potential deuterium isotope effects through burn rate variation. The objective of these studies is the in-situ determination of the rate-controlling reaction step and associated bond rupture which limits HMX's global combustion process. Author

N84-22681# Ballistic Research Labs., Aberdeen Proving Ground, Md.
KINETICS OF THE BETA + DELTA PHASE TRANSFORMATION OF HMX **c28**
Robert A. Fifer *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 581-590 refs (For primary document see N84-22632 13-20)
Avail: NTIS HC A99/MF A01 CSCL 21/9

A differential scanning calorimeter technique was devised for measuring the phase transformation kinetics in crystalline materials. For the beta yields delta transformation of HMX, preliminary results indicate that the process is not homogeneous, but rather takes place as a reaction front, with a propagation velocity of about 40 to 80 micrometer sec at atmospheric pressure, and a low activation energy (approximately 5 kcal/mole). Below a critical crystal size (approximately 400 micrometer), long initiation delays and superheating are observed. The phase transformation propagates from one crystal to another when the crystals are touching. Author

N84-22682# Naval Weapons Center, China Lake, Calif.
MODELING THE SELF-DEFLAGRATION OF HMX **c28**
C. F. Price and T. L. Boggs *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 591-600 refs (For primary document see N84-22632 13-20)
Avail: NTIS HC A99/MF A01 CSCL 21/9

The concept of competing condensed-phase reactions and their role in the determining the self-deflagration rate of HMX is reviewed. A mathematical model is presented in which the gas phase is treated as a flame sheet and the condensed phase reactions are cast as first order distributed reactions with associated heat release or absorption. Results show that the low pressure rate behavior of HMX is better described by distributed (rather than concentrated at a distance) condensed phase reactions due to the extended reaction depth experienced under these conditions. A.R.H.

N84-22683# Army Armament Munitions and Chemical Command, Dover, N.J.
CARS STUDIES OF NITRAMINE LOVA PROPELLANT COMBUSTION **c25**
Kenneth Aron (Geo-Centers, Inc., Newton, Mass.) and L. E. Harris *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 601-610 refs (For primary document see N84-22632 13-20)
(Contract DAAK10-81-C-0266)
Avail: NTIS HC A99/MF A01 CSCL 21/2

Coherent Anti-Stokes Raman Scattering was used to probe the nitramine LOVA flame burning unconfined in air. Spectral regions were scanned in an attempt to document the transient species of the RDX combustion for use in determining decomposition mechanisms. Several species were seen, most notably HCN, CO, N2, and H2. No N2O was seen although its spectrum was seen in model flames. These data are consistent with those models which propose HCN as a decomposition product. A.R.H.

N84-22684# Ballistic Research Labs., Aberdeen Proving Ground, Md.
COMBUSTION THERMODYNAMICS OF SOME BORON-NITROGEN-HYDROGEN COMPOUNDS **c28**
Robert A. Fifer and Irvin C. Stobie *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 611-620 refs (For primary document see N84-22632 13-20)
Avail: NTIS HC A99/MF A01 CSCL 21/9

Combustion tests in a 42.5 cc impetus bomb (P max < 200 MPa) were carried out on five B-N-H compounds: ammonia borane (AB), H3NBH3; the 'diammoniate of diborane' (DDB), H2B(NH3)2BH4: hydrazine bisborane (HBB), H3BN2H3; ammonia triborane (ATB), H3NB3H7; and the diammoniate of tetraborane (DTB), H2B(NH3)2B3H3. The measurements were made for the pure materials, as well as for various mixtures with added HMX. The results are compared with predictions based on BLAKE and NASA-Lewis thermochemical code calculations. All of the B-N-H compounds investigated gave experimental impetus values far below those predicted theoretically; the shortfall decreased with increasing amounts of added HMX. An analysis of the pressure-time traces shows that the energy shortfall is not due to slow burning and concommitant heat loss, but rather to delayed energy release in the combustion products, thus explaining why the phenomenon is largely independent of the starting material. Certain of the B-N-H materials appear to catalyze the combustion of HMX. Author

N84-22685# Lockheed Missiles and Space Co., Palo Alto, Calif.
MODELING EFFECTS OF COMPOSITION ON THE BURN RATES OF NITRATE ESTER-BASED ENERGETIC BINDERS **c28**
N. S. Cohen and C. A. Lo *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 621-628 refs Prepared in cooperation with Cohen (Norman) Professional Services, Redlands, Calif. (For primary document see N84-22632 13-20)
Avail: NTIS HC A99/MF A01 CSCL 21/9

An analytical model is presented which attempts to account for effects of compositional variations on the burning rates of energetic binders. Classical double-base, nitroplastisol and cross-linked double-base binders are considered. The variations are accounted for by differences in the combustion chemistry of the ingredients. Approximations are made to provide closed-form solutions. It is concluded that roughly half of the heat release from reactions involving NO2 occurs in the condensed phase (foam zone), and that the kinetics of the primary gas phase reactions (fizz zone) increases with NO2 content. However, within the framework of the model, the distributions of NO2, heat release and chemistry are not tied together on a consistent a priori basis for all of the binders. A more comprehensive treatment is therefore required. Author

N84-22686# California Inst. of Tech., Pasadena.
NUMERICAL ANALYSIS OF AN UNSTEADY SHOCK IN AN INLET DIFFUSER **c02**
V. Yang and F. E. C. Culick *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 629-634 refs (For primary document see N84-22632 13-20)
(Grant AF-AFOSR-0265-80)
Avail: NTIS HC A99/MF A01 CSCL 01A

A finite difference scheme with a shock-fitting algorithm has been used to investigate the unsteady flow with a shock in a inlet diffuser. The flow field is separated into supersonic and subsonic regions by a normal shock. The response of a shock wave to various disturbances has been studied, including large amplitude periodic oscillations and pulse perturbations. To make the model more realistic, the analysis has been extended to include viscous boundary layer effects treated with an integral method. The shock wave/boundary layer interactions is described by a simple phenomenological model. Calculated mean flow fields were compared with the experimental results reported at McDonnell Douglas Research Laboratory. Good agreement was obtained. No experimental data is available for comparison with the results for unsteady flows. Author

N84-22687*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
NUMERICAL PREDICTIONS OF RESIDENCE TIMES BEHIND A REARWARD FACING STEP WITH TRANSVERSE INJECTION **c02**
R. Clayton Rogers and Elizabeth H. Weidner *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 635-652 refs (For primary document see N84-22632 13-20)
Avail: NTIS HC A99/MF A01 CSCL 01A

A numerical investigation of the two-dimensional recirculation zone formed between a rear-ward facing step and a transverse hydrogen jet in a supersonic flow is presented. Calculations were

made using an elliptic flow computer code with a time-relaxation finite difference integration algorithm. Cases were examined for jet static pressures between 2 and 5 times mainstream with jets located 3 to 7 step heights downstream of the step. Nominal mainstream flow conditions were Mach 2.4 air at 1 atm pressure and 1000K (1800R) static temperature. Results in the form of mean properties in the recirculation zone and residence time are presented. Calculations of the decay of hydrogen mass from the steady state are presented for selected cases. The combustion potential for each case is assessed by comparison of computed conditions in the recirculation zone with the results from a well-stirred reactor theory. Author

N84-22688# Naval Postgraduate School, Monterey, Calif.
THREE-DIMENSIONAL, PRIMITIVE-VARIABLE MODEL FOR SOLID-FUEL RAMJET COMBUSTION
T. Milshtein and D. W. Netzer *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 653-660 refs (For primary document see N84-22632 13-20)
Avail: NTIS HC A99/MF A01 CSCL 21/8

A three-dimensional computer code has been developed for the solid-fuel ramjet combustion process. The code includes finite-rate chemical kinetics and has been used to predict the combustion behavior for axial inlet, side-dump inlet and bypass configurations. Author

N84-22689# Georgia Inst. of Tech., Atlanta.
HETEROGENEOUS DIFFUSION FLAME STABILIZATION: CONSTANT DENSITY RESULTS c25
R. E. Walterick, J. C. Richardson, W. A. DeGroct, W. C. Strahle, J. E. Hubbartt, and J. I. Jagoda *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 661-668 refs (For primary document see N84-22632 13-20)
(Contract F49620-82-C-0013)
Avail: NTIS HC A99/MF A01 CSCL 21/8

Of primary importance to the design of a solid fueled ramjet with backward facing step is the ability to predict the complex flowfield. With this capability, fuel regression rates in the reattachment region and flame stability limits can be predicted. An experimental-analytical approach is taken where the flowfield is documented using noninvasive laser diagnostic techniques and hot-film anemometry for comparison with a flow field analysis based on the familiar k-epsilon turbulence model. Results indicate that mean flowfield quantities can be accurately predicted whereas there are discrepancies between experimental and predicted turbulence quantities. Author

N84-22690# Naval Weapons Center, China Lake, Calif.
DETAILED FLOW MEASUREMENTS IN FUEL-RICH, PARTICLE-LADEN PLUMES c34
M. J. Lee, K. C. Schadow, P. T. Harsha, and R. B. Edelman *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 669-684 refs Prepared in cooperation with Science Applications, Inc., Chatsworth, Calif. (For primary document see N84-22632 13-20)
Avail: NTIS HC A99/MF A01 CSCL 20/4

An experimental study relevant to gas-generator ramjets was performed to study fuel-rich plume combustion in an axisymmetric-coaxial flow field without dump. Tests were performed with gaseous fuels and boron particle-laden gaseous fuels. Radial and axial profiles of temperature, pressure (velocity), and species concentration were obtained. The experimental data were compared with theoretical predictions of the gaseous fuel mixing and combustion process. The data obtained in the baseline gaseous fuel tests were in reasonably good agreement with the analytical predictions. The data for the boron-laden fuel tests indicate that the low combustion temperatures (or low boron combustion efficiency) at low ramjet combustor pressure were due to inefficient gaseous fuel combustions. At low pressure, the gaseous fuels did not provide the temperature environment to initiate high boron reaction rates. The tests in the axisymmetric-coaxial flow field without dump provide a basis for future tests with increased flow complexity. The detailed flow data and additional qualitative observations provide useful information to guide modeling of two-phase flow. Author

N84-22691# Calspan Field Services, Inc., Arnold Air Force Station, Tenn.
COMBUSTION PERFORMANCE OF A VITIATED AIR HEATER FOR A FREEJET TEST FACILITY c25
E. S. Powell *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 685-698 refs Sponsored by AEDC (For primary document see N84-22632 13-20)
Avail: NTIS HC A99/MF A01 CSCL 21/2

The Aerodynamic and Propulsion Test Unit (APTU) at Arnold Engineering Development Center, Arnold AFS, Tennessee is designed to match flight Reynolds numbers over a wide range of Mach numbers and altitudes. The facility operates in the blowdown mode with the enthalpy required to match atmospheric temperatures supplied by instream combustions or vitiation. The effects of the vitiation on test fidelity are assessed using standard techniques based on the composition of the test medium. Two alternative methods of determining the composition, specie measurement and equilibrium calculation, are discussed, and data are presented to support the method appropriate to the test objective. Author

N84-22692*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
VERY LOW THRUST GASEOUS OXYGEN-HYDROGEN ROCKET ENGINE IGNITION TECHNOLOGY
Roy A. Bjorklund *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 699-711 refs Sponsored by NASA (For primary document see N84-22632 13-20)
Avail: NTIS HC A99/MF A01 CSCL 21/8

An experimental program was performed to determine the minimum energy per spark for reliable and repeatable ignition of gaseous oxygen (GO2) and gaseous hydrogen (GH2) in very low thrust 0.44 to 2.22-N (0.10 to 0.50-lb sub f) rocket engines or spacecraft and satellite attitude control systems (ACS) application. Initially, the testing was conducted at ambient conditions, with the results subsequently verified under vacuum conditions. An experimental breadboard electrical exciter that delivered 0.2 to 0.3 mj per spark was developed and demonstrated by repeated ignitions of a 2.22-N (0.50-lb sub f) thruster in a vacuum chamber with test durations up to 30 min. Author

N84-22693 Purdue Univ., Lafayette, Ind.
INVESTIGATION OF COMBUSTION CHARACTERISTICS OF A HIGH CHAMBER PRESSURE ROCKET MOTOR Ph.D. Thesis
Thomas William Carpenter 1969 169 p
Avail: Univ. Microfilms Order No. DA8400446

The objectives of the experimental and analytical investigation were to: (1) successfully operate a rocket motor at a chamber pressure level of 4000 pounds per square inch absolute (PSIA), (2) determine the performance of the high pressure rocket motor, (3) determine the pressure regulated feed system limitations to prevent the occurrence of low frequency instability, (4) monitor the occurrence of high frequency instability of the unpulsed high pressure rocket motor tests, and (5) predict the combustion characteristics of the high pressure rocket tests with the Priem-Heidmann steady state vaporization model. To achieve successful rocket motor operation at 4000 psia chamber pressure, the overshoot in pressure that occurs in the fuel manifold during the start transient must be kept at a minimum. Performance increased with pressure and the performance for the small orifice tube injector was greater than the large orifice tube injector.
Dissert. Abstr.

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N84-22694# Cornell Univ., Ithaca, N.Y.
MODIFICATION OF THE NEAR SURFACE REGION META-

STABLE PHASES AND ION INDUCED REACTIONS Final Technical Report, 1 Apr. 1980 - 30 Sep. 1983
J. W. Mayer 3 Feb. 1984 69 p
(Contract N00014-80-C-0479; DARPA Order 3957)
(AD-A138842) Avail: NTIS HC A04/MF A01 CSCL 11/7

Contents: Rutherford Backscattering Facility; Melt-Front Kinetics; Amorphous Crystalline Phase Formation; NATO Advanced Research Institute; Scientific Personnel and Ph.D Theses; Publications Acknowledging Work Supported in Part by DARPA, and Melt-Front Kinetics and Ion Beam Mixing - Laser Irradiation and Transient Conduction, and Phase Formation in Ion-Mixed Metal-Metal Systems. The investigation was directed toward the formation and characterization of amorphous and crystalline metastable structures formed in the near-surface region of solids. The initial objective was to establish a backscattering and channeling facility. GRA

24 COMPOSITE MATERIALS

Includes laminates.

N84-22695* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DIAMONDLIKE FLAKE COMPOSITES Patent
Bruce A. Banks, inventor (to NASA) Issued 20 Mar. 1984 6 p Filed 17 May 1983
(NASA-Case-LEW-13837-1; US-Patent-4,437,962; US-Patent-Appl-SN-495381; US-Patent-Class-204-192C; US-Patent-Class-204-192R; US-Patent-Class-204-192SP; US-Patent-Class-423-414; US-Patent-Class-423-445; US-Patent-Class-423-446; US-Patent-Class-423-449; US-Patent-Class-423-DIG.10) Avail: US Patent and Trademark Office CSCL 11D

A carbon coating is vacuum arc deposited on a smooth surface of a target which is simultaneously ion beam sputtered. The bombarding ions have sufficient energy to create diamond bonds. Spalling occurs as the carbon deposit thickens. The resulting diamond-like carbon flakes are mixed with a binder or matrix material to form a composite material having improved thermal, electrical, mechanical, and tribological properties when used in aerospace structures and components.
Official Gazette of the U.S. Patent and Trademark Office

N84-22696*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DIAMONDLIKE FLAKES Patent Application
Bruce A. Banks, inventor (to NASA) Filed 19 Mar. 1984 10 p
(NASA-Case-LEW-13837-2; US-Patent-Appl-SN-591089) Avail: NTIS HC A02/MF A01 CSCL 11D

A carbon coating which is vacuum arc deposited on a smooth surface of a target which is simultaneously ion beam sputtered is discussed. The bombarding ions have sufficient energy to create diamond bonds. Spalling occurs as the carbon deposit thickens. The resulting diamondlike carbon flakes have improved thermal, electrical, mechanical, and tribological properties when used in aerospace structures and components. NASA

N84-22697*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
FIRE AND HEAT RESISTANT LAMINATING RESINS BASED ON MALEIMIDO SUBSTITUTED AROMATIC CYCLOTRIPHOSPHAZENES Patent Application
Devendra Kumar (NAS-NRC, Washington, D.C.), George M. Fohlen, and John A. Parker, inventors (to NASA) Filed 11 Apr. 1984 42 p Previously announced in IAA as A84-16347
(NASA-Case-ARC-11428-1; US-Patent-Appl-SN-599126) Avail: NTIS HC A03/MF A01 CSCL 11D

The 4-Aminophenoxy cyclotriphosphazenes were reacted with maleic anhydride to produce maleamic acids which are converted to the maleimides, then the maleimides are polymerized. By selection of starting materials, hexakis amino or trisaminophenoxy-trisphenoxy-cyclotriphosphazenes), selection of molar proportions of reactants, use of mixtures of anhydrides and use of dianhydrides as bridging groups a variety of maleimides and polymers are produced. The polymers have high limiting oxygen indices, high char yields and other useful heat and fire resistant properties making them useful as impregnants of fabrics. NASA

N84-22698*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CHEMICAL APPROACH FOR CONTROLLING NADIMIDE CURE TEMPERATURE AND RATE Patent Application
Richard W. Lauver, inventor (to NASA) Filed 14 Dec. 1983 18 p
(NASA-Case-LEW-13770-3; US-Patent-Appl-SN-561431) Avail: NTIS HC A02/MF A01 CSCL 11D

Polyimide resins suitable for use as composite matrix materials are formed by copolymerization of maleic and norbornenyl end capped monomers and oligomers. The copolymers can be cured at temperatures under about 300 C by controlling the available concentration of the maleic end-capped reactant. This control can be achieved by adding sufficient amounts of said maleic reactant, or by chemical modification of either copolymer, so as to either increase Diels-Alder retrogression of the norbornenyl capped reactant and/or holding initiation and polymerization to a rate compatible with the availability of the maleic-capped reactant. NASA

N84-22699*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CHEMICAL APPROACH FOR CONTROLLING NADIMIDE CURE TEMPERATURE AND RATE Patent Application
Richard W. Lauver, inventor (to NASA) Filed 14 Dec. 1983 18 p
(NASA-Case-LEW-13770-4; US-Patent-Appl-SN-561429) Avail: NTIS HC A02/MF A01 CSCL 11D

Polyimide resins suitable for use as composite matrix materials are formed by copolymerization of maleic and norbornenyl endcapped monomers and oligomers. The copolymers can be cured at temperatures under about 300 C by controlling the available concentration of the maleic-capped reactant. This control can be achieved by adding sufficient amounts of said maleic reactant, or by chemical modification of either copolymer, so as to either increase Diels-Alder retrogression of the norbornenyl capped reactant and/or holding initiation and polymerization to a rate compatible with the availability of the maleic-capped reactant. NASA

N84-22700*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CHEMICAL APPROACH FOR CONTROLLING NADIMIDE CURE TEMPERATURE AND RATE Patent Application
Richard W. Lauver, inventor (to NASA) Filed 14 Dec. 1983 18 p
(NASA-CASE-LEW-13770-5; US-Patent-Appl-SN-561435) Avail: NTIS HC A02/MF A01 CSCL 11D

Polyimide resins suitable for use as composite matrix materials are formed by copolymerization of maleic and norbornenyl endcapped monomers and oligomers. The copolymers can be cured at temperatures under about 300 C by controlling the available concentration of the maleic end-capped reactant. This control can be achieved by adding sufficient amounts of said maleic reactant, or by chemical modification of either copolymer, so as to either increase Diels-Alder retrogression of the norbornenyl capped reactant and/or holding initiation and polymerization to a rate compatible with the availability of the maleic-capped reactant. NASA

N84-22701*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CHEMICAL APPROACH FOR CONTROLLING NADIMIDE CURE TEMPERATURE AND RATE Patent Application

Richard W. Lauver, inventor (to NASA) Filed 14 Dec. 1983 18 p
(NASA-Case-LEW-13770-6; US-Patent-Appl-SN-561434) Avail: NTIS HC A02/MF A01 CSCL 11D

Polyimide resins suitable for use as composite matrix materials are formed by copolymerization of maleic and norbornenyl endcapped monomers and oligomers. The copolymers can be cured at temperatures under about 300 C by controlling the available concentration of the maleic end-capped reactant. This control can be achieved by adding sufficient amounts of said maleic reactant, or by chemical modification of either copolymer, so as to either increase Diels-Alder retrogression of the norbornenyl capped reactant and/or holding initiation and polymerization to a rate compatible with the availability of the maleic-capped reactant. NASA

N84-22702*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SELECT FIBER COMPOSITES FOR SPACE APPLICATIONS: A MECHANISTIC ASSESSMENT
C. A. Ginty and C. C. Chamis 1984 26 p refs Presented at the 29th SAMPE Symp. and Exhibition, Reno, Nev., 3-5 Apr. 1984
(NASA-TM-83631; E-2069; NAS 1.15:83631) Avail: NTIS HC A03/MF A01 CSCL 11D

Three fiber composites (graphite-fiber epoxy, graphite-fiber aluminum, and graphite-fiber magnesium) are evaluated for their possible use in space applications. Using the composite mechanics theories for thermomechanical behavior embodied in the ICAN (Integrated Composites Analyzer) computer code, select composite thermal and mechanical properties are predicted and also their response to cryogenic temperatures, resembling those which occur in space applications. The predicted results are presented in graphical form as a function of the composite's laminate configuration, fiber volume ratio and the selected use temperature. These results are suitable for preliminary design purposes only and should serve as an aid in selecting controlled experiments for obtaining corresponding measured data. Author

N84-22703# Naval Surface Weapons Center, White Oak, Md.
MOISTURE TRANSPORT IN COMPOSITES DURING REPAIR WORK
J. M. Augl Sep. 1983 33 p
(WR0-2204; F41-422)
(AD-A138658; NSWC/TR-83-374) Avail: NTIS HC A03/MF A01 CSCL 15/5

The increased use of composites for structural materials in modern Naval aircraft (wing skins) requires reliable repair techniques for damaged areas (holes or delaminations). It is desirable to carry out these repairs under field or depot conditions by adhesively bonding a metal or composite patch over the damaged area. The problem is to prevent excessive void formation in the adhesive bond caused by evaporation of water during the curing process. Moisture that had been sorbed into the composite may diffuse into the adhesive. If the partial pressure of water dissolved in the still liquid adhesive exceeds the environmental (applied) pressure voids may form rapidly and reduce the load carrying strength of the bonded patch. An interactive desk top computer program was written for predicting the moisture profiles in the composite and the adhesive during the whole course of predrying and patch bonding. Thus it should be possible to get a better understanding of the problem and to obtain guidance for an experimental approach to optimize repair procedures. The underlying principles for the modeling are discussed and a specific example of moisture transport using a metal patch is given.
Author (GRA)

N84-22704# California Univ., Livermore. Lawrence Livermore Lab.
MATRIX-DOMINATED TIME-DEPENDENT DEFORMATION AND DAMAGE OF GRAPHITE/EPOXY COMPOSITE EXPERIMENTAL DATA UNDER CREEP AND RECOVERY Final Report, Jan. 1981 - Sep. 1982
E. M. Wu, R. J. Sanchez, and N. Z. Nguyen Wright-Patterson AFB, Ohio AFWAL Jun. 1983 395 p
(Contract MIPR-FY-1456-81-0014; AF Proj. 2307)
(AD-A139064; UCID-19789; AFWAL-TR-83-3066) Avail: NTIS HC A17/MF A01 CSCL 11/4

The objective of this report is to disseminate experimental data of matrix-dominated time-dependent deformation and time-dependent damage in graphite-epoxy composite. The composite specimens were + or - 45 deg T300/5208 laminates tested in tension under creep and creep-recovery with complete instrumentation for stress, strain, and time recordings. Experimental data was recorded and archived in digital form. Polynomial series are fitted to the experimental data for compilation, dissemination and future retrieval. GRA

N84-22705# California Univ., Livermore. Lawrence Livermore Lab.
HYDROLYTIC DEGRADATION OF KEVLAR 49 FIBERS
Roger J. Morgan, Cesar O. Pruneda, Nora Butler, Fung-Ming Kong, Len Caley, and Richard L. Moore 5 Dec. 1983 11 p refs Presented at the 29th Natl. SAMPE Symp., Reno, Nev., 3-5 Apr. 1984
(Contract W-7405-eng-48)
(DE84-004158; UCRL-89625; CONF-840459-2) Avail: NTIS HC A02/MF A01

The hydrolytic degradation of Kevlar 49 fibers and the principal parameters that control this degradation are presented. Hydrolytic chain scission of the amide linkage and corresponding fiber strength deterioration are considered in terms of RH, time, temperature and stress level. The rates of hydrolytic degradation at 100% RH in the 100 to 200 (0)C range are reported. The estimated rates of fiber degradation in various service environment conditions are also reported and shown not to be serious. The impurities present in Kevlar 49 fibers and their effect on hydrolytic degradation are also discussed. The aging of Kevlar 49 fibers as a result of exposure to UV and stress are reviewed. DOE

N84-22706# California Univ., Livermore. Lawrence Livermore Lab.
MODES OF DEFORMATION AND FAILURE OF KEVLAR 49 FIBERS AND COMPOSITES
Cesar O. Pruneda, Roger J. Morgan, Fung-Ming Kong, Jean A. Hodson, Robert P. Kershaw, and Alton W. Casey 5 Dec. 1983 10 p refs Presented at the 29th Natl. SAMPE Symp., Reno, Nev., 3-5 Apr. 1984
(Contract W-7405-eng-48)
(DE84-004162; UCRL-89626; CONF-840459-3) Avail: NTIS HC A02/MF A01

Fracture topography and stress optical microscopy are utilized to study the deformation and failure modes of Kevlar 49 fibers and their epoxy composites. Fracture topographies of bare yarns, composite strands, and pressure vessels reveal Kevlar 49 fibers fail in tension by axially splitting 20 to 50 times their diameter D (20 to 50D) along their lengths. This type of fiber failure involves shear induced microvoid growth throughout the fiber which occurs principally along the fiber axis, followed by macroscopic crack propagation through such microscopic crack propagation through such microvoids. Fiber splitting in the fracture of single filaments is < because of the absence of external shear stresses. The topographies observed in fractured single filaments are described in terms of longitudinal and transverse fiber crack propagation paths in the fiber skin and core. Hydrolytically degraded Kevlar 49 fibers exhibit lower fiber split lengths in composites. There is a correlation between the percentage of fibers that exhibit transverse failure without splitting and the composite strength. Stress optical microscopy studies of the deformation and failure processes of simple composite laminates are reported as a function of laminate geometry, temperature, and fiber surface treatment. DOE

N84-22707# Centre National de la Recherche Scientifique, Orleans (France). Centre de Recherches sur la Chimie de la Combustion et des Hautes Temperatures.
THEORETICAL INFLUENCE OF THE DEPOSITION CONDITIONS ON THE UNIFORMITY OF BORON CARBIDE COATINGS

L. Vandenbulcke 1983 7 p refs Presented at 4th European Conf. on CVD, 1983
Avail: NTIS HC A02/MF A01

Vapor deposition of boron carbide from BC13 - CH4 - H2 was studied by a model coupling surface kinetics and diffusion through the boundary layer. It is applied to a deposition system where the direction of gas flow is parallel to a flat surface. This system exhibits the double influence of the depletion of the reactants and the variation of the boundary layer thickness along the surface. The results can be qualitatively extended to other geometries where these problems are encountered such as deposition inside tubes, the deposition on complex shaped substrates, or in large scale deposition chambers. Author (ESA)

N84-22708 Michigan Univ., Ann Arbor.
MICROWAVE CURING OF COMPOSITES Ph.D. Thesis
Woo Il Lee 1983 167 p
Avail: Univ. Microfilms Order No. DA8402312

Models were developed which describe the interaction between linearly polarized transverse electromagnetic waves or isotropic electromagnetic wave and continuous fiber-reinforced organic matrix composites, and which simulate the microwave curing of such composites. On the basis of the models, a computer code was developed which provides the reflectance, transmittance, total absorbed energy, and absorbed energy distribution inside the composite. The computer code also yields the temperature distribution, the resin viscosity, and the degree of cure of resin during microwave curing of flat plate composites. In addition, the computer code gives the amount of resin flow out of the composite and the resin contents of the composite and the bleeder. Tests were performed using a waveguide measuring the reflectances and transmittances of Fiberite S2/9134B glass epoxy and Hercules AS/3501-6 graphite epoxy composites. Tests were also conducted using a microwave oven measuring the temperature distribution inside Fiberite S2/9134B glass epoxy composites, and the temperature distribution inside and resin flow out of Hercules AS/3501-6 graphite epoxy composites. Dissert. Abstr.

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*

N84-22709* National Aeronautics and Space Administration. Pasadena Office, Calif.
SUPERCRITICAL SOLVENT COAL EXTRACTION Patent
Leslie E. Compton, inventor (to NASA) (California Inst. of Tech., Pasadena) Issued 17 Apr. 1984 7 p Filed 17 Nov. 1981 Sponsored by NASA
(NASA-Case-NPO-15210-1; US-Patent-4,443,321;
US-Patent-Appl-SN-322312; US-Patent-Class-208-8LE;
US-Patent-Class-208-10) Avail: US Patent and Trademark Office CSCL 07D

Yields of soluble organic extract are increased up to about 50% by the supercritical extraction of particulate coal at a temperature below the polymerization temperature for coal extract fragments (450 C.) and a pressure from 500 psig to 5,000 psig by the conjoint use of a solvent mixture containing a low volatility, high critical temperature coal dissolution catalyst such as phenanthrene and a high volatility, low critical temperature solvent such as toluene.

Official Gazette of the U.S. Patent and Trademark Office

N84-22710 Arizona Univ., Tucson.
COMPUTER CONTROLLED LASER OPTOACOUSTIC SPECTROSCOPY FOR TRACE GAS ANALYSIS Ph.D. Thesis
Scott Bradley Tilden 1983 280 p
Avail: Univ. Microfilms Order No. DA8401276

Optoacoustic spectroscopy is a relatively old technique first described by Alexander Graham Bell in 1881. With the advent of laser infrared light sources in the 1960's, there has been a resurgence of interest in optoacoustics. No longer is low source intensity a major limitation to successful optoacoustic spectroscopy. Although adequate infrared light sources are available, the large window background signal observed in all optoacoustic systems has been the major limitation in extending trace gas detection limits to the ppb or sub-ppb level. Similarly, there has been little demonstration of the use of the optoacoustic technique in environments where mixtures of gases are present which have severe spectral overlap. This work will discuss a new windowless cell design that largely eliminates the signal background problem ubiquitous to all presently available optoacoustic cells. New methodologies will be discussed that allow analyses of mixtures to be performed even in cases where spectral overlap is severe. Limitations to both the windowless cell and the various multicomponent analysis strategies are discussed. Dissert. Abstr.

N84-22711 City Univ. of New York, N. Y.
LIQUID-PHASE PHOTOIONIZATION DETECTOR FOR LIQUID CHROMATOGRAPHY Ph.D. Thesis
Bhim Sen Dhingra 1983 128 p
Avail: Univ. Microfilms Order No. DA8401927

A wide variety of detection schemes have been developed in pursuance of the development of a universal, sensitive detector for high pressure liquid chromatography (HPLC). Although useful, none of these detectors approach the sensitivity of the flame ionization detection (FID) for gas chromatography (GC). In the present work a direct liquid phase photoionization detector with picogram sensitivity to polycyclic aromatic hydrocarbons in normal phase chromatography is described. This detection is based on the selective photoionization of the eluent. Photoionization in liquids is a more complex phenomenon than that in gases. In liquids Pi electron photocurrents are observed for incident photo energies 2-4 eV less than the vacuum IP values. In liquids, it is also possible to have secondary reactions in addition to the simple solvation of the productions. Dissert. Abstr.

N84-22712*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SEPARATOR DEVELOPMENT AND TESTING OF NICKEL-HYDROGEN CELLS
Olga D. Gonzalez-Sanabria and Michelle A. Manzo 1984 15 p refs To be presented at the 19th Intersoc. Energy Conversion Eng. Conf., San Francisco, 19-24 Aug. 1984
(NASA-TM-83653; E-2017; NAS 1.15:83653) Avail: NTIS HC A02/MF A01 CSCL 10C

The components, design, and operating characteristics of Ni-H2 cells batteries were improved. A separator development program was designed to develop a separator that is resistant to penetration by oxygen and loose active material from then nickel electrode, while retraining the required chemical and thermal stability, reservoir capability, and high ionic conductivity. The performance of the separators in terms of cell operating voltage was to at least match that of state-of-the-art separators while eliminating the separator problems. The separators were submitted to initial screening tests and those which successfully completed the tests were built into Ni-H2 cells for short term testing. The separators with the best performance are tested for long term performance and life. S.L.

N84-22713# Pennsylvania State Univ., University Park. Dept. of Materials Science and Engineering.
ON THE LIMITING ELECTRODE POTENTIAL IN CAVITIES AND ITS ROLE IN DECIDING BETWEEN SCC (STRESS CORROSION CRACKING) AND HC (HYDROGEN CRACKING) IN METALS
H. W. Pickering Feb. 1984 24 p
(Contract N00014-81-K-0025)
(AD-A138585) Avail: NTIS HC A02/MF A01 CSCL 07/4

This paper reviews the conditions needed to determine whether aqueous-phase crack propagation occurs due to hydrogen (HC) or due to anodic metal dissolution (SCC). It shows that the

main question to be answered is whether overlap of the electrode potential regions of the metal dissolution and hydrogen evolution reactions increases or decreases with increasing distance x into a cavity or crack. It also reviews the theoretical and experimental basis of the recently discovered existence of a limiting electrode potential in a cavity, a finding which is paramount to the goal of this paper. GRA

N84-22714# Massachusetts Inst. of Tech., Cambridge.
X-RAY PHOTOELECTRON AND AUGER ELECTRON SPECTROSCOPIC STUDY OF THE CdTe SURFACE RESULTING FROM VARIOUS SURFACE PRETREATMENTS: CORRELATIONS OF PHOTOELECTROCHEMICAL AND CAPACITANCE-POTENTIAL BEHAVIOR WITH SURFACE CHEMICAL COMPOSITION
A. J. Ricco, H. S. White, and M. S. Wrighton 7 Feb. 1984 21 p Submitted for publication
(Contract N00014-75-C-0880)
(AD-A138601; TR-41) Avail: NTIS HC A02/MF A01 CSCL 07/4

The surface chemistry and stoichiometry of p- and n-type CdTe photoelectrodes treated with oxidizing and reducing etches have been characterized by X-ray photoelectron and Auger electron spectroscopies. The results of surface analysis have been correlated with the photoelectrochemical and capacitance-potential behavior of the photoelectrodes. Oxidized surfaces are covered by a thin Te/TeO2 layer (or a thicker Te layer, if the etching procedure is slightly altered), resulting in Fermi level pinning: a constant photovoltage is found for a wide range of redox potentials and potential-independent space charge layer capacitance obtains. Reduced surfaces closely resemble ion sputtered CdTe in chemical state and stoichiometry, resulting in more nearly ideal behavior: the semiconductor/electrolyte interface is rectifying in the dark; capacitance-potential behavior follows the Mott-Schottky equation near flat band conditions; and photovoltage varies with redox potential, from 0 to approx. 0.7 V for p-CdTe. Author (GRA)

N84-22715# Naval Postgraduate School, Monterey, Calif.
THREE-DIMENSIONAL, PRIMITIVE-VARIABLE MODEL FOR SOLID-FUEL RAMJET COMBUSTION Final Report, for period ending 1983
T. Milshtein and D. W. Netzer Feb. 1984 26 p
(AD-A138756; NPS-67-84-001) Avail: NTIS HC A03/MF A01 CSCL 21/2

A three-dimensional computer code has been developed for the solid-fuel ramjet combustion process. The code includes finite-rate chemical kinetics and has been used to predict the combustion behavior for axial inlet, side-dump inlet and bypass configurations. Author (GRA)

N84-22716# Purdue Univ., Lafayette, Ind. Dept. of Chemistry.
INTRAMOLECULAR ELECTRON TRANSFER AT METAL SURFACES. 1. RELATIVE ENERGETICS OF SOME CORRESPONDING OUTER- AND INNER-SPHERE PATHWAYS INVOLVING HALIDE AND PSEUDOHALIDE BRIDGING LIGANDS
S. W. Barr and M. J. Weaver Nov. 1983 31 p
(Contract N00014-79-C-0670)
(AD-A139021; AD-E401136; TR-23) Avail: NTIS HC A03/MF A01 CSCL 07/4

The electroreduction kinetics of a number of Co(III) ammine and ethylene-diamine complexes containing chloride, bromide, and isothiocyanate ligands have been studied at platinum- and gold-aqueous interfaces in order to investigate the consequences of attaching simple transition-metal reactants to electrocatalytic metal surfaces upon the electron-transfer energetics. The virtues of evaluating unimolecular rate constants k sub et (per sec) for comparing the energetics of electrochemical inner- and outer-sphere pathways are pointed out. GRA

N84-22717# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
VORTEX MOTION IN A PRECOMBUSTION CHAMBER WITH INTERSECTING JETS
A. S. Ippolitov and S. P. Safronov 10 Feb. 1984 15 p Transl. into ENGLISH from Tr. Mosk. Energ. Inst. (USSR), No. 150, 1972 p 43-50
(AD-A139040; FTD-ID(RS)T-1712-83) Copyright. Avail: NTIS HC A02/MF A01 CSCL 20/4

A large number of theoretical and experimental studies are devoted to laws governing the vortex motion in a limited volume. The main characteristics of the cyclonic chambers are calculated. The agreement of the calculation formulas with experimental data confirms the correctness of the accepted model of the vortex motion in the precombustion chamber. Author

N84-22718# Purdue Univ., Lafayette, Ind. Dept. of Chemistry.
ELECTRON-TRANSFER KINETICS OF REDOX CENTERS ANCHORED TO METAL SURFACES: WEAK- VERSUS STRONG-OVERLAP REACTION PATHWAYS Technical Report
S. W. Barr, K. L. Guyer, T. T. T. Li, H. Y. Liu, and M. J. Weaver Nov. 1983 19 p
(Contract N00014-79-C-0670)
(AD-A139043; TR-17) Avail: NTIS HC A02/MF A01 CSCL 07/4

Unimolecular rate constants k sub et are presented for the one-electron electroreduction of various CoIII(NH3)5X complexes bound to mercury, platinum, and gold surfaces via either small inorganic or extended organic ligands X. These surface intramolecular rate parameters are compared with estimates of k sub et for outer-sphere pathways obtained from homogeneous rate data in order to ascertain the consequences of reactant-surface binding upon the electron-transfer energetics. Only small or moderate decreases in the elementary reorganization barrier Delta G* sub et occur upon surface attachment, suggesting the occurrence of weak-overlap pathways. Aside from the dependence of k sub et upon the bridging ligand X at a given electrode potential due to differences in thermodynamic driving force, the observed variations in k sub et appear to be due in part to variations in the electronic transmission coefficient k sub el. Author (GRA)

N84-22719# Purdue Univ., Lafayette, Ind. Dept. of Chemistry.
OBSERVATION OF SURFACE-ENHANCED RAMAN SCATTERING FOR TRANSITION-METAL HEXAAMMINE CATIONS AT THE OUTER HELMHOLTZ PLANE: IMPLICATIONS FOR ENHANCEMENT MECHANISMS AT ELECTROCHEMICAL INTERFACES
M. A. Tadayyoni, S. Farquharson, and M. J. Weaver Nov. 1983 10 p
(Contract N00014-79-C-0670)
(AD-A139045; TR-25) Avail: NTIS HC A02/MF A01 CSCL 07/4

The recent observation of surface-enhanced Raman scattering (SERS) for a variety of adsorbates at silver in electrochemical and gas-phase environments has generated a plethora of theoretical models to account for the remarkable (ca.1,000,000 fold) observed enhancement of the Raman scattering intensities. These models can be divided into those demanding only the presence of the Raman scatterer at or close to the metal surface ('physical models'), and those requiring specific adsorbate-surface interactions ('chemical models'). Prompted in part by the especially intense SERS seen for specifically adsorbed species at silver electrodes, a widely held viewpoint is that the enhancement is due in part to chemical interactions between the Raman scatterer and the metal surface, possibly involving as adsorbate-adatom 'complex'. The report examines SERS of inorganic adsorbates at silver-aqueous interfaces. One objective is to examine systematically how the SER spectra are influenced by the nature of the adsorbate-surface interactions. GRA

N84-22720# Purdue Univ., Lafayette, Ind. Dept. of Chemistry.
INTRAMOLECULAR ELECTRON TRANSFER AT METAL SURFACES. 2: COMPARISONS OF LIGAND-BRIDGED CR(3) REDUCTION KINETICS AT SILVER VERSUS MERCURY ELECTRODES
K. L. Guyer and M. J. Weaver Nov. 1983 30 p
(Contract N00014-79-C-0670)
(AD-A139047; TR-22) Avail: NTIS HC A03/MF A01 CSCL 07/4

Rate parameters have been gathered for the electroreduction of a number of Cr(III) complexes attached to silver electrodes via one or more thiocyanate, azide, chloride, or bromide bridging ligands. Unimolecular rate constants k sub et (per sec) for electron transfer within the adsorbed states as well as the surface concentration of the adsorbates were obtained directly using rapid linear sweep voltammetry. These data are also compared with corresponding kinetics and adsorption measurements at mercury electrodes in order to deduce the structure factors responsible for the substantially greater overall reactivities (i.e., larger apparent rate contents k sub app) seen at silver. Marked differences in k sub et, as well as k sub app, were found between silver and mercury surfaces these differences being sensitive to the nature of the nonbridging as well as the bridging ligands. This indicates that the metal surface exerts a significant influence upon the energetics of the elementary electron-transfer step as well as upon the stability of the precursor intermediate. GRA

N84-22721# Purdue Univ., Lafayette, Ind. Dept. of Chemistry.
SURFACE-ENHANCED RAMAN SPECTROSCOPY OF ELECTROCHEMICALLY CHARACTERIZED INTERFACES. RELATIONS BETWEEN RAMAN SCATTERING INTENSITY AND SURFACE COVERAGE FOR SIMPLE ANIONIC ADSORBATES
M. J. Weaver, J. T. Hupp, F. Barz, J. G. Gordon, II, and M. R. Philpott 14 Nov. 1983 26 p
(Contract N00014-79-C-0670)
(AD-A139054; TR-16) Avail: NTIS HC A03/MF A01 CSCL 07/4

Surface-Enhanced Raman Scattering (SERS) obtained as a function of electrode potential for chloride, bromide, iodide, thiocyanate, azide, and cyanide adsorbed at roughened silver electrodes are compared with corresponding surface concentration-potential data extracted from differential capacitance measurements in order to examine the relation between SERS and surface coverage for these structurally simple adsorbates. After generating SERS by means of an oxidation-reduction cycle, it was found that altering the potential to a more negative value, where the adsorbate coverage fell below a monolayer, corresponded closely in most cases to the onset of a potential-dependent decay in the SERS intensity. Monitoring the potential dependence of the Raman intensity with an Optical Multi-channel Analyzer as well as with a conventional scanning spectrometer allowed a rapid reversible component of the potential dependence to be separated from an additional irreversible signal decay associated with the loss of Raman-active sites. The present results suggest that the adsorption energetics of the Raman-active surface sites do not differ substantially from those for the sites occupied by the majority of the adsorbate. GRA

N84-22722# Purdue Univ., Lafayette, Ind. Dept. of Chemistry.
UTILITY OF SURFACE REACTION ENTROPIES FOR EXAMINING REACTANT-SOLVENT INTERACTIONS AT ELECTROCHEMICAL INTERFACES. FERRICINIUM-FERROCENE ATTACHED TO PLATINUM ELECTRODES
J. T. Hupp and M. J. Weaver Nov. 1983 16 p
(Contract N00014-79-C-0670)
(AD-A139055; TR-19) Avail: NTIS HC A02/MF A01 CSCL 07/4

Reactant-solvent interactions are of prime importance to both the kinetics and thermodynamics of electrode processes. Since electrochemical reactions inevitably occur within the interfacial region, it is desirable to gain information on the nature of reactant solvation at the electrode surface as well as in bulk solution. We have demonstrated that useful information on the latter for simple redox couples can be obtained from the so-called reaction entropy, determined from the temperature dependence of the formal potential, using a nonisothermal cell arrangement. GRA

N84-22723# Purdue Univ., Lafayette, Ind. Dept. of Chemistry.
REDOX THERMODYNAMICS OF SURFACE-BOUND REACTANTS. ILLUSTRATIVE BEHAVIOR OF COBALT(3)/(2) MACROBICYCLIC CAGE COMPLEXES
J. T. Hupp, P. A. Lay, H. Y. Liu, W. H. F. Petri, and A. M. Sargeson Nov. 1983 15 p
(Contract N00014-79-C-0670)
(AD-A139058; TR-18) Avail: NTIS HC A02/MF A01 CSCL 07/4

The electrochemistry of surface-bound couples is an area of considerable current interest. In addition to their potential applications in electrocatalysis, such couples that involve mechanistically uncomplicated one-electron transfer offer opportunities for studying several fundamental aspects of heterogeneous electron-transfer processes. For example, the interpretation of electrochemical rate parameters for surface-attached reactants is especially straightforward, since these provide direct information on the energetics of the elementary electron-transfer step. The comparison between redox thermodynamics of a given redox couple in solution and in the surface-bound state are expected to yield useful insights into the differences in the solvating environment between the interfacial region and the bulk solution. Bulk solution and surface thermodynamic behavior for two Co(III)/(II) redox couples adsorbed by different means is presented here in order to illustrate the virtues of such analyses for simple electrode reactions. GRA

N84-22724# Purdue Univ., Lafayette, Ind. Dept. of Chemistry.
A METHOD FOR EVALUATING THE SURFACE CONCENTRATIONS OF 2 LIKE-CHARGED IONS SIMULTANEOUSLY ADSORBED AT AN ELECTRODE-SOLUTION INTERFACE
J. T. Hupp and M. J. Weaver Dec. 1983 10 p
(Contract N00014-79-C-0670)
(AD-A139074; TR-26) Avail: NTIS HC A02/MF A01 CSCL 07/4

A recent preliminary report by Gonzales and co-workers highlights the experimental difficulties in determining the amounts of specific adsorption of two types of ions simultaneously present at a mercury-aqueous interface. The authors note that the elegant analysis of Lakshmanan and Rangarajan required such a large amount of data that the method has scarely ever been employed. There are additional difficulties with this analysis when employed at solid electrode surfaces. It is desirable to find a method that could readily be applied at polycrystalline solid, as well as liquid, electrodes. This reports outlines such an analysis for determining the simultaneous adsorption of like-charged ions, based on a simple extension of the well-known Hurwitz-Parsons approach. These authors demonstrated independently that the amount of specific adsorption of, for example, an anion X can be assessed from differential capacitance-potential data for a series of mixed electrolytes containing varying proportions of the salts BX and BY at a constant total ionic strength, where Y is an anion that is not specifically adsorbed. The electrocapillary equation can be written in terms of salt chemical potentials. GRA

N84-22725# Purdue Univ., Lafayette, Ind. Dept. of Chemistry.
THE INFLUENCE OF SPECIFIC REACTANT-SOLVENT INTERACTIONS ON INTRINSIC ACTIVATION ENTROPIES FOR OUTER-SPHERE ELECTRON TRANSFER REACTIONS
J. T. Hupp and M. J. Weaver Nov. 1983 22 p
(Contract N00014-79-C-0670)
(AD-A139081; TR-21) Avail: NTIS HC A02/MF A01 CSCL 07/4

The physical basis of the solvent contribution to the intrinsic activation entropy, Delta S* Sub int, for outer-sphere electron-transfer reactions in homogeneous solution is examined in terms of the entropic parameters for the constituent electrochemical half reactions. A relationship for calculating Delta S* Sub int is derived which takes into account specific reactant-solvent interactions for the isolated redox centers by employing electrochemical reaction entropy data. This relation yields rather larger and more structure-sensitive values of Delta S* Sub int than those deduced on the basis of the usual dielectric continuum treatment. These considerations indicate that the more negative values of Delta S* Sub int typically extracted from experimental kinetic data arise largely from the modification to the specific reactant-solvent interactions within the precursor complex caused by the proximity of the other redox center. Author (GRA)

N84-22726# Pennsylvania State Univ., University Park. Dept. of Chemistry.
ORGANOMETALLIC CHEMISTRY OF WEAKLY SOLVATED TRANSITION METAL CATIONS Final Report, 1 Aug. 1981 - 31 Jul. 1984
Ayusman Sen Dec. 1983 9 p refs
(Contract DE-AC02-81ER-10992)
(DE84-006987; DOE/ER-10992/2) Avail: NTIS HC A02/MF A01

The catalytic chemistry of a number of weakly solvated transition metal cations were studied. Several of these appear to be versatile catalysts for the linear polymerization, the linear and cyclic oligomerization and the rearrangement of a wide range of olefinic substrates as well as, the rearrangement of strained ring compounds. These diverse catalytic reactions were shown to go through a common mechanistic pathway involving the initial heterolytic cleavage of either the C-C)PI) bond of the olefin or the strained C-C sigma bond of the ring compound to generate incipient carbocationic intermediates. It is discovered that cationic, tertiary phosphine complexes of Pd (II) catalyze the copolymerization of carbon monoxide with olefins under unusually mild conditions. It is indicated that the products arise through a mechanism involving a single mode of stepwise chain growth, and that it is possible to control the molecular weight distribution of the copolymer by a rational choice of solvents. It is found that tertiary phosphine complexes of Rh(I) catalyze the cooligomerization of carbon monoxide with olefins to polyketones and polyketoesters. The mechanism involves a single mode of chain growth and the product distribution can be regulated by proper choice of solvents. DOE

N84-22727# Centre National de la Recherche Scientifique, Orleans (France). Centre de Recherches sur la Chimie de la Combustion et des Hautes Temperatures.
MECHANISM OF SOOT FORMATION IN PREXIMED C2H2/O2 FLAMES
Jean-Louis Delfau and Christian Vovelle 1983 25 p refs Presented at 9th Colloq. Intern. Dyn. des Gaz, Explosions et Systemes Reactifs, Poitiers, France, 3 - 8 Jul. 1983
Avail: NTIS HC A02/MF A01

Neutral species in rich C2H2/O2 premixed flat flame stabilized under reduced pressure were analyzed by coupled molecular beam-mass spectrometry. In order to investigate whether particular variations are observed at the sooting limit (2.1) 6 flames of equivalence ratio 1.8, 2.0, 2.1, 2.2, 2.6 and 3.0 were studied. The roles played by polyacetylenic hydrocarbons and polycyclic aromatic hydrocarbons (PAH) in the mechanism of soot formation were compared. Profiles of mole fraction and mass fraction flux versus distance to the burner show that polyacetylenics cannot be considered as active intermediates. A strong reactivity is observed at the boundary between oxidation and soot formation zones for PAH. Variation of the profiles of mass fraction flux for species containing one to six carbon atoms, and the role played by deshydrogenation reactions were studied. Results suggest that C4H4 plays a major role in the first step of the mechanism of soot formation. Author (ESA)

N84-22728# Centre National de la Recherche Scientifique, Orleans (France). Centre de Recherches sur la Chimie de la Combustion et des Hautes Temperatures.
A SHOCK TUBE STUDY OF CHLORINE AZIDE DECOMPOSITION
C. Paillard, G. Dupre, and N. A. Fomin (Academy of Sciences, Minsk, USSR) 1983 26 p refs Presented at 9th Colloq. Intern. sur la Dyn. des Gaz, Explosions et Systemes Reactifs, Poitiers, France, 3 - 8 Jul. 1983
Avail: NTIS HC A03/MF A01

The thermal decomposition of N3Cl diluted in argon was studied behind incident shock waves within a temperature range of 500 to 1200 K, between 50 and 600 Torr. Exothermicity effects on shock wave propagation are notable with mixtures containing 5 and 2 mol % N3Cl: a coupling between the reaction and the shock wave is observed above a minimum shock strength. An induction period is detected before coupling. When the shock strength increases, the induction period disappears for 5 mol, and the wave rapidly accelerates but remains lower than the theoretical Chapman-Jouguet velocity. With the mixture containing 0.5 mol.% N3Cl, the exothermicity effect is small. A self-photolysis phenomenon occurs; before the shock wave transfer, a partial decomposition produced by emissions in front of the shock wave is noted. For the lowest pressures and the poorest mixture in N3Cl self-photolysis is not detected. Author (ESA)

N84-22729# Bayer A.G., Leverkusen (West Germany).
PHYSICAL AND CHEMICAL INVESTIGATIONS ON REAL CATALYST SURFACES Final Report, Aug. 1982
Guenther Bayer, Hans-Georg Fitzky, Reimer Holm, Helmuth Keiser, Richard Menold, Gerold Mueller, Guenter Oppermann, Juergen Scharschmidt, Siegfried Storp, Laszio Imre et al Bonn Bundesministerium fuer Forschung und Technologie Dec. 1983 199 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie Prepared in cooperation with Westfaelische Wilhelms Univ.
(BMFT-FB-T-83-273; ISSN-0340-7608) Avail: NTIS HC A09/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 36,50

Catalysts were studied under reaction conditions which approximate the technical ones as close as possible. Methods of physical analysis were implemented and improved in instruments combined with microreactors, including in situ coupling of microreactors with a microwave resonator, an X-ray diffractometer, an electron spin resonance spectrometer, an IR spectrometer, the on line and off line coupling of microreactors with various surface analysis techniques (Auger electron spectroscopy, photoelectron spectroscopy, secondary ions mass spectroscopy), as well as raster electron microscopy. Metal and oxide catalyst, e.g., for the oxidation of butene, naphthalene, and methanol, and for hydrogeneation reactions were investigated. Author (ESA)

N84-22730# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
INVESTIGATIONS OF RADICAL-RADICAL REACTIONS USING A FAR INFRARED LASER MAGNETIC RESONANCE (FIR-LMR) SPECTROMETER Thesis - Georg-August-Universitaet, Goettingen, West Germany [UNTERSUCHUNG VON RADIKAL-RADIKAL-REAKTIONEN MIT HILFE EINES FIR-LMR-SPEKTROMETERS]
Friedrich Temps Apr. 1983 141 p refs In GERMAN
(MPIS-4/1983; ISSN-0436-1199) Avail: NTIS HC A07/MF A01; Fachinformationszentrum, Karlsruhe, West Germany

Velocity constants and products of fast radical-radical reactions in the gas phase in oxyhydrogen, ammonia, and hydrocarbon systems were investigated in isothermal flow systems using a high sensitivity FIR-LMR spectrometer. The radicals are obtained in sources in which no by products affecting the reaction kinetics are produced. The method can study the reactions under conditions where chain reactions do not play a role. Single channels can be discrimated and the validity of established reaction mechanisms can be checked by the simultaneous measurement of reactants and reaction products concentrations. Author (ESA)

N84-22731# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
MASS SPECTROSCOPIC INVESTIGATIONS OF THE REACTIONS OF O2 (1 DELTAg) WITH FURAN, 2-METHYLFURAN, AND 2.5-DIMETHYLFURAN IN THE GAS PHASE Thesis [MASSENSPEKTROMETRISCHE UNTERSUCHUNGEN DER REAKTION VON O2 (1 DELTAg) MIT FURAN, 2-METHYLFURAN UND 2.5-DIMETHYLFURAN IN DER GASPHASE]
Eckhard Fiedler Jul. 1983 81 p refs In GERMAN
(MPIS-7/1983; ISSN-0436-1199) Avail: NTIS HC A05/MF A01; Fachinformationszentrum, Karlsruhe, West Germany

The chemical reaction between electronically excited oxygen and furans was investigated in an isothermal flow system in the temperature domain between 300 and 640 K, and at pressures between 1.5 and 3.5 mbar. The samples are directly and continuously introduced in the ion source of a quadrupole mass

spectrometer via a molecular beam inlet system. Reaction velocity constants are measured and the reaction products formation is analyzed. The temperature dependence of the reactions is described by Arrhenius laws. Author (ESA)

N84-22732# National Academy of Sciences - National Research Council, Washington, D. C.
CURRENT TRENDS IN ATOMIC SPECTROSCOPY Final Report, 9 Aug. 1982 - 31 Jul. 1984
Feb. 1984 94 p Presented at a Workshop held at Tucson, Ariz., 24-26 Oct. 1982
(Grants NSF PHY-82-06076; AF-AFOSR-0172-82)
(PB84-162957) Avail: NTIS HC A05/MF A01 CSCL 07D

This report addresses the current status as well as the future of atomic spectroscopy. A workshop was held in Tucson, AZ, from October 24-26, 1982 to produce this report, articulating the collective opinion of the 'state of the art' in current research and on goals for future research. The workshop and this report were funded by the Air Force Office of Scientific Research and the National Science Foundation, with additional funds provided by Spectra-Physics and International Business Machines. The report assesses the systematics of atomic spectra, theoretical techniques, experimental techniques, compilations and tabulations, and the applications of atomic spectroscopy. GRA

N84-22629# Florida Univ., Gainesville. Dept. of Mechanical Engineering.
ULTRAVIOLET OH EMISSIONS IN H2-AIR DIFFUSION FLAMES
K. M. Pamidimukkala, P. F. Schippnick, D. B. Vaidya, and A. E. S. Green *In* APL The 14th JANNAF Plume Technol. Meeting, Vol. 1 Nov. 1983 p 117-122 refs (For primary document see N84-22619 13-20)
Avail: NTIS HC A07/MF A01 CSCL 21/2

N84-22636# Army Armament Munitions and Chemical Command, Dover, N.J.
THEORETICAL CALCULATION OF H/SUB 2 S- AND Q-BRANCH SPECTRA FOR PROPELLANT FLAMES
Joanne Fendell, L. E. Harris, and Kenneth Aron (Geo-Centers, Inc.) *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 35-42 refs (For primary document see N84-22632 13-20)
Avail: NTIS HC A99/MF A01 CSCL 21/2

N84-22639# Purdue Univ., Lafayette, Ind. School of Aeronautics and Astronautics.
INSITU MEASUREMENT OF BURNING RATE
R. L. Glick, H. Pressley, and M. Bielak *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 61-70 refs (For primary document see N84-22632 13-20)
(Contract AFOSR-NTP-0638)
Avail: NTIS HC A99/MF A01 CSCL 21/2

N84-22640# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Mechanical Engineering.
MEASUREMENT OF SOLID PROPELLANT BURNING RATES EMPLOYING MICROWAVE TECHNIQUES
H. L. Wood, W. F. OBrien, Jr., and C. B. Dale (Naval Ordnance Station) *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 71-80 refs (For primary document see N84-22632 13-20)
(Contract N00174-81-C-0039)
Avail: NTIS HC A99/MF A01 CSCL 21/2

N84-22643# United Technologies Corp., San Jose, Calif. Chemical Systems Div.
COUPLING BETWEEN VELOCITY OSCILLATIONS AND SOLID PROPELLANT COMBUSTION
R. S. Brown, P. C. Willoughby, and R. Dunlap *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 107-124 refs (For primary document see N84-22632 13-20)
(Contract F49620-81-C-0027)
Avail: NTIS HC A99/MF A01 CSCL 21/2

N84-22658# Hercules, Inc., Magna, Utah. Aerospace Div.
A SUMMARY OF THE MECHANISMS OF DELAYED DETONATION
A. G. Butcher, K. P. McCarty, R. L. Keefe, and E. J. Blommer *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 293-318 refs (For primary document see N84-22632 13-20)
(Contract N00030-C-82-C0101)
Avail: NTIS HC A99/MF A01 CSCL 21/2

N84-22662# Gough (Paul) Associates, Inc., Portsmouth, N.H.
CONTINUUM MODELING OF STICK CHARGE COMBUSTION
Paul S. Gough *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 351-364 refs (For primary document see N84-22632 13-20)
(Contracts N00174-80-C-0316; DAAK11-82-C-0053)
Avail: NTIS HC A99/MF A01 CSCL 21/2

N84-22669# Army Armament Munitions and Chemical Command, Dover, N.J. Fire Control and Small Caliber Weapon Systems Lab.
NEUTRON RADIOGRAPHIC STUDY OF LIQUID PROPELLANT COMBUSTION
Michael P. Devine and Bruce W. Brodman *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 463-472 Prepared in cooperation with Oregon State Univ., Corvallis and GE, Burlington, Vt. (For primary document see N84-22632 13-20)
(Contracts DAAK10-78-C-0323; DAAK10-79-C-0221)
Avail: NTIS HC A99/MF A01 CSCL 21/2

N84-22670# Ballistic Research Labs., Aberdeen Proving Ground, Md.
LIQUID PROPELLANT IGNITION STUDIES
Nathan Klein *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 473-482 refs (For primary document see N84-22632 13-20)
Avail: NTIS HC A99/MF A01 CSCL 21/2

N84-22671# Applied Combustion Technology, Inc., Orlando, Fla.
EXPANDED IGNITION EFFECTIVENESS TESTS OF SELECTED IGNITER MATERIALS WITH NAVY PROPELLANTS
A. Michael Varney, John Martino, and Rod Henry *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 483-492 refs (For primary document see N84-22632 13-20)
(Contract N00174-31-C-0453)
Avail: NTIS HC A99/MF A01 CSCL 21/2

N84-22673# Ballistic Research Labs., Aberdeen Proving Ground, Md.
EFFECT OF O2 ON DOUBLE-BASE PROPELLANT IGNITION
A. Cohen and H. E. Homes *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 499-504 refs (For primary document see N84-22632 13-20)
Avail: NTIS HC A99/MF A01 CSCL 21/2

N84-22678# Applied Combustion Technology, Inc., Orlando, Fla.
IGNITIBILITY STUDIES OF LOVA PROPELLANTS
A. Michael Varney, John Martino, and Rod Henry *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 547-556 refs (For primary document see N84-22632 13-20)
(Contract N00174-81-C-0453)
Avail: NTIS HC A99/MF A01 CSCL 21/2

N84-22683# Army Armament Munitions and Chemical Command, Dover, N.J.
CARS STUDIES OF NITRAMINE LOVA PROPELLANT COMBUSTION
Kenneth Aron (Geo-Centers, Inc., Newton, Mass.) and L. E. Harris *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 601-610 refs (For primary document see N84-22632 13-20)
(Contract DAAK10-81-C-0266)
Avail: NTIS HC A99/MF A01 CSCL 21/2

N84-22689# Georgia Inst. of Tech., Atlanta.
HETEROGENEOUS DIFFUSION FLAME STABILIZATION: CONSTANT DENSITY RESULTS
R. E. Walterick, J. C. Richardson, W. A. DeGroct, W. C. Strahle, J. E. Hubbartt, and J. I. Jagoda *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 661-668 refs (For primary document see N84-22632 13-20)
(Contract F49620-82-C-0013)
Avail: NTIS HC A99/MF A01 CSCL 21/8

N84-22691# Calspan Field Services, Inc., Arnold Air Force Station, Tenn.
COMBUSTION PERFORMANCE OF A VITIATED AIR HEATER FOR A FREEJET TEST FACILITY
E. S. Powell *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 685-698 refs Sponsored by AEDC (For primary document see N84-22632 13-20)
Avail: NTIS HC A99/MF A01 CSCL 21/2

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N84-22733# British Library Lending Div., Boston Spa (England).
THERMOELASTIC STRESSES IN METAL WITH TEMPERATURE: DEPENDENT PROPERTIES IN RADIANT HEATING
Yu. S. Postolnik Mar. 1984 8 p refs Transl. into ENGLISH from Izv. (USSR) p 111-114
(BLL-M-35526-(5828.4)) Avail: British Library Lending Div., Boston Spa, Engl.

Equations are derived from published data and used to indicate the significant of the temperature dependence of metal properties (particularly thermal conductivity, modulus of elasticity and coefficient of thermal expansion) in calculations of safe thermal stresses in radiant heating. Examples are worked for several cases of the heating of different steels, with a comparison between the calculated stresses and the tensile strength of the steelgrades included. The procedure is used to establish refined furnace operating regime parameters. M.A.C.

N84-22734* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
METHOD OF MAKING A LIGHT WEIGHT BATTERY PLAQUE Patent
Margaret A. Reid, Robert E. Post, and Daniel G. Soltis, inventors (to NASA) Issued 27 Mar. 1984 6 p Filed 19 Feb. 1982
(NASA-Case-LEW-13349-1; US-Patent-4,439,465;
US-Patent-Appl-SN-350476; US-Patent-Class-427-115;
US-Patent-Class-29-623.5; US-Patent-Class-427-125;
US-Patent-Class-427-126.6; US-Patent-Class-427-296;
US-Patent-Class-427-306; US-Patent-Class-429-223;
US-Patent-Class-429-234) Avail: US Patent and Trademark Office CSCL 11F

A nickel plaque which may be coated with a suitable metal or compound to make an electrode for a fuel cell or battery is fabricated by directing nickel sensitizer, catalyst and plating solutions through a porous plastic substrate in the order named and at prescribed temperatures and flow rates. A boride compound dissolved in the plating solution decreases the electrical resistance of the plaque. Certain substrates may require treatment in an alkali solution to dissolve filler materials thereby increasing porosity to a required 65%.
Official Gazette of the U.S. Patent and Trademark Office

N84-22735*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
REVIEW OF THE EFFECTS OF MICROSTRUCTURE ON FATIGUE IN ALUMINUM ALLOYS Ph.D. Thesis - Cincinnati Univ.
Jack Telesman Apr. 1984 36 p refs
(NASA-TM-83626; E-2061; NAS 1.15:83626) Avail: NTIS HC A03/MF A01 CSCL 11F

Literature survey was conducted to determine the effects of different microstructural features and different load histories on fatigue crack initiation and propagation of aluminum alloys. Comparison of microstructure and monotonic and cyclic properties between powder metallurgy (P/M) and ingot metallurgy (I/M) alloys is presented. The two alloys that are representative of each process on which the comparison is focused are X7091 and 7050. Included is a detailed description of the microstructure produced through the P/M and I/M processes. The effect of each pertinent microstructural feature on monotonic and cyclic properties, such as yield strength, toughness, crack initiation and propagation is discussed. Also discussed are the proposed mechanisms for crack initiation and propagation, as well as the effects of aggressive environments on these cyclic properties. The effects of variable amplitude loadin on fatigue crack propagation and the various models proposed to predict load interaction effects are discussed. S.L.

N84-22736# Naval Postgraduate School, Monterey, Calif.
THE HEAT TREATMENT RESPONSE OF THERMOMECHANICALLY PROCESSED M-50 STEEL M.S. Thesis
E. V. Bres Dec. 1983 70 p
(AD-A138571) Avail: NTIS HC A04/MF A01 CSCL 11/6

The heat treatment response of M-50 steel, thermomechanically processed by warm rolling, was compared to that of the same material in a conventional, spherodize-annealed condition. Warm rolling of M-50 produces markedly finer microstructures than does conventional processing, and may result in enhanced fracture resistance in such a steel. This work examined the effect of austenitizing time and temperature on warm rolled material, comparing its response to that of a conventional, spheroidized starting condition. Warm rolled sampled demonstrated significantly higher hardness and retained their finer microstructures after short austenitizing times of treatment at low austenitizing temperatures. The hardness difference is attributed to faster dissolution of finer carbides. Using warm rolled M-50, a given hardness is achieved using shorter austenitizing times or lower austenitizing temperatures than for conventional M-50. Author (GRA)

N84-22737# American Univ., Washington, D. C.
CLARIFICATION OF ENVIRONMENTAL EFFECTS IN STRESS CORROSION CRACKING Final Report, 1 Jun. 1975 - 31 Dec. 1983
R. T. Foley Jan. 1984 26 p
(Contract N00014-75-C-0799)
(AD-A138581) Avail: NTIS HC A03/MF A01 CSCL 11/6

The objective of this project was to clarify the role of the environment in the stress corrosion cracking and the localized corrosion of aluminum alloys. Specifically, the project addressed the manner in which different chemical species, such as various anions, are involved in the corrosion process. Author (GRA)

N84-22738# Connecticut Univ., Storrs. Inst. of Materials Science.
THE FATIGUE OF POWDER METALLURGY ALLOYS Annual Scientific Report, 1 Dec. 1982 - 30 Nov. 1983
A. J. McEvily 17 Jan. 1984 44 p
(Grant AF-AFOSR-0046-81; AF Proj. 2306)
(AD-A138714; AFOSR-84-0111TR) Avail: NTIS HC A03/MF A01 CSCL 11/6

Experimental work on the fatigue crack growth characteristics of high strength P/M (Powder Metallurgy) aluminum alloys has been extended, with particular attention given to crack closure in the near threshold region as a function of R. It has been conclusively shown that the R-dependence of the threshold level is directly related to closure. In the absence of closure as in ultra-fine grained material the threshold level is independent of the R-ratio. Experimental work has been initiated on the growth of fatigue cracks under variable amplitude loading conditions. An approach to deal with topics such as the anomalous growth of short cracks, the non-propagation of cracks from notches, fatigue notch sensitivity, and the notch size-effect in fatigue has been developed. A comparison of the fatigue behavior of powder metallurgy and ingot metallurgy products has been initiated. Thus

far out work indicates that P/M products can be produced which are free from manufacturing defects which might degrade fatigue properties of these high strength aluminum alloys. The fatigue properties are responsive to grain size, fracture toughness, and the degree of closure developed. GRA

N84-22739# Lehigh Univ., Bethlehem, Pa. Center for Surface and Coatings Research.
CORROSION CONTROL THROUGH A BETTER UNDERSTANDING OF THE METALLIC SUBSTRATE/ORGANIC COATING/INTERFACE Annual Report, No. 4, 1 Sep. 1982 - 30 Sep. 1983
H. Leidheiser, Jr., E. M. Allen, M. S. El-Aasser, F. M. Fowkes, and R. D. Granata 1 Jan. 1984 248 p
(Contract N00014-79-C-0731)
(AD-A139086) Avail: NTIS HC A11/MF A01 CSCL 11/6

This report represents the fourth annual summary of research carried out under Office of Naval Research. The objective of this research is to obtain a better understanding of the metallic substrate/organic coating/interface system so that improvements may be made in corrosion control of metals by painting. The report this year includes a summary of progress made in 16 different components of the program. These activities are arranged for convenience into those primarily concerned with (1) corrosion at the interface, (2) the chemistry of the metal/coating interface, (3) the properties of the coating, (4) the properties of iron oxides with particular relevance to the painting of rusted steel. GRA

N84-22740# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.
REVISION OF DESIGN VALUES FOR 7075-T7351 AND 7075-T7651 ALUMINUM PLATE Final Report, Aug. 1982 - May 1983
J. D. Tirpak Jan. 1984 28 p
(DA Proj. 241-8)
(AD-A139092; AFWAL-TR-83-4128) Avail: NTIS HC A03/MF A01 CSCL 11/6

Varying thicknesses of 7075-T7351 and 7075-T7651 aluminum plates were mechanically tested to verify certain design allowables used in the initial B-1 design. For the 7075-T7351 alloy, tensile and compressive strengths decreased slightly with increasing plate thickness. 7075-T7351 shear strengths increased very slightly with increased plate thickness. Bearing strengths varied noticeably with plate thickness, therefore requiring two data sets to characterize design allowables. This variation was at least partially due to different specimen location. For the 7075-T7651 alloy, more test plates of varying thicknesses are needed for a complete statistical analysis. Author (GRA)

N84-22741# California Inst. of Tech., Pasadena.
SHOCK CONSOLIDATION OF POWDERS: THEORY AND EXPERIMENT
T. Vreeland, Jr., P. Kasiraj, T. J. Ahrens, and R. B. Schwarz (ANL) Jan. 1984 6 p refs Presented at the Mater. Res. Soc. Ann. Meeting, Boston, 14-17 Nov. 1983 Sponsored in part by United Technologies Research Center and DARPA through the U.S. Army Materials and Mechanics Research Center
(Contract W-31-109-eng-38)
(DE84-007273; CONF-831174-81) Avail: NTIS HC A02/MF A01

A model of shock consolidation of powders which quantitatively predicts regimes of input energy and shock duration required to produce well bonded compacts is discussed. A data base from shock experiments in which the shock wave and powder parameters of importance are controlled allows evaluation of the model. Rapidly solidified crystalline AISI 9310, and microcrystalline Markomet 3.11, as well as amorphous Markomet 1064 and crystalline Mo powders, were consolidated by shocks up to 2 (MU)s duration. The formation of amorphous layers on Marko 3.11 particle surfaces indicates that surface melting and rapid solidification occurred. Decreasing amounts of amorphous structure are retained in Marko 3.11 and 1064 powder compacts with increasing shock energies. Significant improvement in Mo particle bonding is achieved by reducing surface oxides prior to shock consolidation. DOE

N84-22742# Rolls-Royce Ltd., Derby (England).
THE FUTURE FOR TITANIUM AND SUPERALLOYS
G. W. Meetham 1 Oct. 1983 15 p refs
(PNR-90175; Reprint-878) Avail: NTIS HC A02/MF A01

The state of the art in titanium and nickel superalloys in aircraft engines, and future property requirements are discussed. Titanium alloys are used for compressor disks and blades with nickel superalloys being used in the hotter turbine and reheat components. Until recently the uses of titanium and nickel superalloys were distinct and complementary but they are now becoming interactive, with titanium alloys replacing lower temperature nickel superalloys in certain components. Despite developments which improve engine performance, titanium and superalloys meet increasing competition from other material systems, tending to limit any increase in their total use in gas turbine engines. Author (ESA)

N84-22743# Rolls-Royce Ltd., Derby (England).
THE CYCLIC BEHAVIOUR OF A POWDER NI-BASE SUPERALLOY
M. A. Hicks, R. A. Newley, and B. P. Towill 1983 21 p refs
(PNR-90182; Reprint-895) Avail: NTIS HC A02/MF A01

The influence of the inherent defect population in Astroloy derived superalloys on cyclic properties was tested. The role of defects in fatigue, and the interaction of microstructure crack size, temperature and stress conditions on the mode and rate of crack growth were studied. The selection and interpretation of test piece data for the prediction of safe lives for components in fatigue is discussed. Results show that defects should not prevent application in gas turbine components provided their presence is recognized and a total disk lifing system which involves modifications of existing fatigue life and fracture mechanics methods is applied. This can result in a significant improvement in operating stresses and cyclic life over conventionally produced nickel base materials. Author (ESA)

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N84-22744* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PROCESS FOR PREPARING PERFLUOROTRIAZINE ELASTOMERS AND PRECURSORS THEREOF Patent
Robert W. Rosser (San Jose State Univ., Calif.), Timothy S. Chen (San Jose State Univ., Calif.), and Chung-Heng Cheng, inventors (to NASA) (San Jose State Univ., Calif.) Issued 28 Feb. 1984 8 p Filed 6 Apr. 1982 Sponsored by NASA
(NASA-Case-ARC-11402-1; US-Patent-4,434,106; US-Patent-Appl-SN-366025; US-Patent-Class-260-465.5R; US-Patent-Class-528-362; US-Patent-Class-528-401; US-Patent-Class-528-422; US-Patent-Class-528-423; US-Patent-Class-544-215; US-Patent-Class-260-465.6; US-Patent-Class-564-243) Avail: US Patent and Trademark Office CSCL 11G

Perfluoroether triazine elastomers having improved properties and utility in seals, gaskets, sealing components and the like are prepared from oligomeric imidoylamidines that have, in turn, been prepared by the process of (1) reacting a perfluorodinitrile with liquid ammonia to yield a perfluorodiamidine, (2) isolating the perfluorodiamidine, (3) reacting the isolated diamidine with a perfluorodinitrile to yield a perfluoror(imidoylamidine) dinitrile, and then repeating step (1), (2), and (3) to sequentially grow an oligomer of desired molecular size. The isolated amidine and nitrile intermediates are also described.

Official Gazette of the U.S. Patent and Trademark Office

N84-22745* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

PHOSPHORUS-CONTAINING IMIDE RESINS Patent
Indra K. Varma (NAS-NRC, Washington, D.C.), George M. Fohlen (NAS-NRC, Washington, D.C.), and John A. Parker, inventors (to NASA) (NAS-NRC, Washington, D.C.) Issued 21 Feb. 1984 9 p Filed 11 Jul. 1983 Continuation-in-part of US Patent-4,395,557, US Patent Appl. SN-288267, filed 30 Jul. 1981
(NASA-Case-ARC-11368-3; US-Patent-4,433,115;
US-Patent-4,395,557; US-Patent-Appl-SN-512795;
US-Patent-Appl-SN-288267; US-Patent-Class-525-417;
US-Patent-Class-428-370; US-Patent-Class-428-408;
US-Patent-Class-428-902; US-Patent-Class-428-920;
US-Patent-Class-526-262; US-Patent-Class-528-228;
US-Patent-Class-528-322; US-Patent-Class-548-415) Avail: US Patent and Trademark Office CSCL 11G

Flame-resistant reinforced bodies are disclosed which are composed of reinforcing fibers, filaments or fabrics in a cured body of bis- and tris-imide resins derived from tris(m-aminophenyl) phosphine oxides by reaction with maleic anhydride or its derivatives, or of addition polymers of such imides, including a variant in which a mono-imide is condensed with a dianhydride and the product is treated with a further quantity of maleic anhydride.

Official Gazette of the U.S. Patent and Trademark Office

N84-22746* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
THERMOSET-THERMOPLASTIC AROMATIC POLYAMIDE CONTAINING N-PROPARGYL GROUPS Patent
Terry L. St.Clair (Virginia Polytechnic Inst. and State Univ., Blacksburg), James F. Wolfe (Virginia Polytechnic Inst. and State Univ., Blacksburg), and Thomas D. Greenwood, inventors (to NASA) (Virginia Polytechnic Inst. and State Univ., Blacksburg) Issued 14 Feb. 1984 6 p Division of Serial No. 199,768, filed 23 Oct. 1980, US Patent No. 4,395,540 Sponsored by NASA
(NASA-Case-LAR-12723-2; US-Patent-4,431,792;
US-Patent-Appl-SN-447371; US-Patent-Class-528-183;
US-Patent-Class-525-426; US-Patent-Class-528-220;
US-Patent-Class-528-345; US-Patent-Class-528-348;
US-Patent-4,395,540; US-Patent-Appl-SN-199768) Avail: US Patent and Trademark Office CSCL 11G

The compounds of the class of aromatic polyamides useful as matrix resins in the manufacture of composites or laminate fabrication were developed. The process for preparing this thermoplastic-thermoset polyamide system involves incorporating a latent crosslinking moiety along the backbone of the polyamide to improve the temperature range of fabrication thereof wherein the resin softens at a relatively low temperature (approx. 154 C) and subsequently sets-up or undergoes crosslinking when subjected to higher temperature (approx. 280 C).

Official Gazette of the U.S. Patent and Trademark Office

N84-22747* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ETHYNYL AND SUBSTITUTED ETHYNYL-TERMINATED POLYSULFONES Patent
Paul M. Hergenrother, inventor (to NASA) Issued 14 Feb. 1984 7 p Filed 8 Oct. 1982
(NASA-Case-LAR-12931-1; US-Patent-4,431,761;
US-Patent-Appl-SN-433598; US-Patent-Class-524-171;
US-Patent-Class-525-534; US-Patent-Class-525-535;
US-Patent-Class-525-536; US-Patent-Class-528-25;
US-Patent-Class-528-26) Avail: US Patent and Trademark Office CSCL 11G

Ethynyl and substituted ethynyl-terminated polysulfones and a process for preparing the same are disclosed. These polysulfones are thermally cured to induce cross-linking and chain extension, producing a polymer system with improved solvent resistance and use temperature. Also disclosed are substituted 4-ethynylbenzoyl chlorides as precursors to the substituted ethynyl-terminated polysulfones and a process for preparing the same.

Official Gazette of the U.S. Patent and Trademark Office

N84-22748* National Aeronautics and Space Administration. Pasadena Office, Calif.
ABSORBABLE-SUSCEPTOR JOINING OF CERAMIC SURFACES Patent
James E. Schroeder (California Inst. of Tech., Pasadena) and Paul J. Shlichta, inventors (to NASA) (California Inst. of Tech., Pasadena) Issued 13 Dec. 1983 10 p Filed 10 Feb. 1983 Sponsored by NASA
(NASA-Case-NPO-15640-1; US-Patent-4,420,352;
US-Patent-Appl-SN-465367; US-Patent-Class-156-89;
US-Patent-Class-156-304.3; US-Patent-Class-156-304.6;
US-Patent-Class-156-81; US-Patent-Class-156-499) Avail: US Patent and Trademark Office CSCL 11A

An assembly of ceramic surfaces particularly refractory metal oxides and carbides, abutting a thin sheet of metal susceptor material are placed in a chamber of an enclosure containing inert gas. An RF coil is activated by power supply to melt the susceptor and adjacent zones of the ceramic. Reactive gas such as oxygen or a carbonizing gas is then fed to the chamber and reacts with the susceptor to form compounds which disperse and dissolve in the zones. On cooling, a strong joint is formed. The susceptor may contain inner perforations and outer perforations to aid in distribution of heat.

Official Gazette of the U.S. Patent and Trademark Office

N84-22749* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
POLYPHENYLENE ETHERS WITH IMIDE LINKING GROUPS Patent
Terry L. St.Clair and Harold D. Burks, inventors (to NASA) Issued 24 Apr. 1984 6 p Filed 25 Feb. 1983
(NASA-Case-LAR-12980-1; US-Patent-4,444,979;
US-Patent-Appl-SN-469866; US-Patent-Class-528-172;
US-Patent-Class-528-125; US-Patent-Class-528-128;
US-Patent-Class-528-185) Avail: US Patent and Trademark Office CSCL 11G

Novel polyphenylene ethers with imide linking units are disclosed. These polymers incorporate the solvent and thermal resistance of polyimides and the processability of polyphenylene ethers. Improved physical properties over those of the prior art are obtained by incorporating meta linked ethers and/or polyphenylene oxides into the polymer backbone. A novel process for making polymers of this type is also disclosed. The process is unique in that the expected need of high process temperatures and/or special atmospheres are eliminated.

Official Gazette of the U.S. Patent and Trademark Office

N84-22750* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
CARBORANYLMETHYLENE-SUBSTITUTED PHOSPHAZENES AND POLYMERS THEREOF Patent
Harry R. Allcock (Pennsylvania State Univ., University Park) and Angelo G. Scopelianos, inventors (to NASA) (Pennsylvania State Univ., University Park) Issued 24 Apr. 1984 8 p Filed 3 May 1983 Sponsored by NASA
(NASA-Case-ARC-11370-1; US-Patent-4,444,972;
US-Patent-Appl-SN-491125; US-Patent-Class-528-6;
US-Patent-Class-525-389; US-Patent-Class-528-7;
US-Patent-Class-528-394; US-Patent-Class-528-399;
US-Patent-Class-568-4; US-Patent-Class-568-5) Avail: US Patent and Trademark Office CSCL 11G

Carboranylmethylene-substituted cyclophosphazenes are described which can be thermally polymerized into carboranylmethylene-substituted phosphazene polymers. The polymers are useful as thermally stable coatings. Also, due to the characteristics of these polymers in acting as a ligand for transition metals, metalocarboranylmethylene phosphazene polymers are described which can act as immobilized catalyst systems, and are electrically conductive and superconductive.

Official Gazette of the U.S. Patent and Trademark Office

N84-22751 Massachusetts Univ., Amherst.
DEFORMATION STUDIES OF POLYMERS BY FOURIER TRANSFORM INFRARED SPECTROSCOPY Ph.D. Thesis
Donald Joseph Burchell, Jr. 1983 266 p

Avail: Univ. Microfilms Order No. DA8401047

A combination of mechanical-vibrational spectroscopy was developed to characterize the deformation induced microstructural changes in polymers. With this technique, extremely accurate macroscopic mechanical information in the form of stress-strain data is collected along with microscopic information in the form of infrared data. The information obtained yielded insights into various aspects of the mechanism of molecular deformation. Initially a hydraulic tensile tester was designed and interfaced to the Fourier transform infrared spectrometer (FTIR). This tester incorporates a closed-loop DC servo-controller, which drives a servo-valve. Using the feed-back loop from the load cell or strain gauge, both the stroke and load are programmable. It is capable of performing various types of deformation experiments with extreme accuracy, wide frequency response, and variable deformation amplitude. Several time resolved Fourier transform infrared techniques have also been developed to measure the rate of molecular motion with sufficient time resolution, accuracy, and wide spectral range. Dissert. Abstr.

N84-22752*# Harvard Univ., Cambridge, Mass. Div. of Applied Sciences.

BULK FORMATION OF METALLIC GLASSES AND AMORPHOUS SILICON FROM THE MELT Semiannual Report

Frans Spaepen Mar. 1984 4 p refs

(Contract NAS8-35416)

(NASA-CR-171012; NAS 1.26:171012) Avail: NTIS HC A02/MF A01 CSCL 11B

Procedures and compositions for producing metallic glasses in bulk at slow cooling rates were investigated. An attempt was made to form the amorphous phase of the tetrahedrally coordinated elements (Si or Ge) by undercooling the melt. The crystal nucleation behavior of pure liquids and glass formers were examined. S.L.

N84-22753*# California Univ., Los Angeles. Dept. of Materials Science and Engineering Science.

CERAMIC-TO-METAL BONDING FOR PRESSURE TRANSDUCERS Final Report

John D. Mackenzie Apr. 1984 29 p refs

(Grant NAG3-295)

(NASA-CR-173500; NAS 1.26:173500) Avail: NTIS HC A03/MF A01 CSCL 11A

A solid-state diffusion technique involving the placement of a gold foil between INCONEL X-750 and a machinable glass-ceramic 'MACOR' was shown to be successful in bonding these two materials. This technique was selected after an exhaustive literature search on ceramic-metal bonding methods. Small expansion mismatch between the Inconel and the MACOR resulted in fracture of the MACOR when the bonded body was subjected to tensile stress of 535 psi. The bonded parts were submitted to a cyclic loading test in an air atmosphere at 1 Hz from 0 to 60 KPa. Failure was observed after 700,000 cycles at 650 C. Ceramic-Inconel bonding was not achieved with this method for boron nitride and silica glass. Author

N84-22754# Texas A&M Univ., College Station. Dept. of Chemistry.

CHEMICAL PROPERTIES AND FILM CASTING OF RADIATION GRAFTED ION-CONTAINING POLYMERS

M. N. Szentirmay and C. R. Martin 27 Feb. 1984 37 p Presented at the Rocky Mountain Conf., Denver, Jul. 1983

(Contract N00014-82-K-0612)

(AD-A138551; TR-3) Avail: NTIS HC A03/MF A01 CSCL 11/9

A series of radiation grafted cation and anion exchange polymers have been studied with the intent of developing procedures for dissolving and film casting these polymers. Solvent swelling studies have shown that these polymers display two maxima in plots of solvent uptake vs. solvent solubility parameter. While similar behavior is shown by the ion exchange polymer Nafion, the anion and cation exchange polymers studied here will not dissolve under conditions (developed by us) which dissolve Nafion. We believe this insolubility results from covalent cross links and/or enhanced crystallinity in the chain material regions of these polymers. These polymers, do however, swell extensively in certain solvents at high temperatures and suspensions may be prepared from the swollen polymer. We have cast films from these suspensions onto electrode surfaces and report initial results of electrochemical characterization of these films. Author (GRA)

N84-22755# Case Western Reserve Univ., Cleveland, Ohio. Ultrasonics Research Lab.

COMPRESSIBILITY OF COLLOIDS. 2: COMPRESSIBILITY STUDIES OF TRI-BLOCK NON-IONIC POLYMERS IN TOLUENE AND WATER SOLUTIONS

M. A. Barrett-Gultepe, M. E. Gultepe, J. L. McCarthy, and E. B. Yeager 20 Jan. 1984 34 p

(Contract N00014-82-K-0112)

(AD-A138738; TR-50) Avail: NTIS HC A03/MF A01 CSCL 11/9

Ultrasonic velocity measurements were made on a series of Pluronics i.e., tri-block non-ionic co-polymers of poly(ethylene oxide) poly(propylene oxide) poly(ethylene oxide) in solvents showing near ideal and non-ideal behavior. Aqueous solutions of the Pluronics studied show non-ideal behavior - namely nonlinear apparent compressibility as a function of Pluronic concentration. This nonideality is thought to arise from aggregate formation. This is confirmed by laser light scattering measurements. Those polymers that dissolved in toluene showed near ideal behavior enabling us to determine intrinsic compressibilities of hydrophobic and hydrophilic blocks as 4.9 x 10 to the minus 11th power dyn/sq cm 2 and 3.9x10 to the minus the 11th power dyn/sq cm 2 respectively. The volume fraction of the bound water per segment of poly (ethylene oxide) is estimated and found to be dependent on the segment population. The mathematical treatment presented in this paper stems from that of Shiio, but goes further to define possible limits to the true compressibility, volume and density of bound water rather than making the assumption that no contraction of the water occurs. Author (GRA)

N84-22756# Naval Surface Weapons Center, White Oak, Md.

EFFECT OF PRESSURE ON THE STATIC AND DYNAMIC ACOUSTIC PROPERTIES OF POROUS RUBBER

G. C. Gaunaurd, E. Callen, and J. Barlow 1 Oct. 1983 37 p

(AD-A138744; NSWC/TR-83-450) Avail: NTIS HC A03/MF A01 CSCL 12/1

In this report we analyze the effects of pressure on the acoustic properties of porous rubbers. We consider the static and dynamic bulk moduli, the velocities of dilatational and shear waves, the characteristic wave impedances, the fundamental frequency of the monopole resonance, and the frequency dependence of the effective sound speed and attenuation. A series of figures at the end of the report shows how the (static) acoustic properties vary with pressure, and how the dynamic properties of the composite are altered by added pressures as high as 400 psi. Author (GRA)

N84-22757# Akron Univ., Ohio. Inst. of Polymer Science.

EFFECT OF INTERFACIAL BONDING ON THE STRENGTH OF ADHESION OF ELASTOMERS. 3: INTERLINKING BY MOLECULAR ENTANGLEMENTS

A. N. Gent and R. H. Tobias Feb. 1984 28 p

(Contract N00014-76-C-0408)

(AD-A138760; TR-30) Avail: NTIS HC A03/MF A01 CSCL 20/11

Polydimethylsiloxane (PDMS) networks have been formed by endlinking linear PDMS molecules. When second layer is cast on top of a fully-gelled lower-layer, the new molecules diffuse into the surface of the lower layer and form molecular loops (entanglements) in the course of endlinking with themselves. The two layers are then joined only by the macromolecular loops. Measurements have been made of the work required to separate such layers under threshold conditions, i.e., at low rates, high temperatures, and, in some cases, in the swollen state. Values of the work of detachment have been found to be generally about one-half of the work of fracture of the layers themselves, and consistent with the inferred density of interlinking molecular loops

at the interface. The values were higher for higher densities, roughly in proportion, and for interlinking molecular strands of higher molecular weight, in accordance with the theory of Lake and Thomas. In the absence of interlinking the work of detachment was extremely small. GRA

N84-22758# Akron Univ., Ohio. Inst. of Polymer Science.
MICROMECHANICS OF FRACTURE IN ELASTOMERS
A. N. Gent and C. T. R. Pulford Feb. 1984 33 p
(Contract N00014-76-C-0408)
(AD-A138783; AD-F300387; TR-32) Avail: NTIS HC A03/MF A01 CSCL 11/10

A study of torn surfaces and of the tips of propagating tears in elastomers has been carried out using scanning electron microscopy. Vertical steps separating smooth featureless torn regions are characteristics features of the torn surfaces. They are found to be more frequency and larger in stronger elastomers. They are attributed to the intersection of secondary cracks at the tear tip, displace somewhat from the general tear plane, and nucleated by inherent stress-raisers. The effective diameter of the tear tip is therby increased. Stress-raising features are inferred to be present in elastomeric materials at a typical spacing of 10-100 micrometer. In carbon-black-filled elastomers, the carbon particles themselves are found to nucleate secondary cracks profusely. Author (GRA)

N84-22759# Garrett Turbine Engine Co., Phoenix, Ariz.
CONTACT-STRESS ANALYSIS OF ELASTIC-VISCOELASTIC INTERFACE CONDITIONS Final Technical Report, Oct. 1980 - Oct. 1983
J. R. Smyth Jan. 1984 44 p
(Contract N00014-80-C-0870)
(AD-A138834; Rept-21-4140(2)) Avail: NTIS HC A03/MF A01 CSCL 11/2

The sliding contact (frictional) behavior of sintered alpha silicon carbide (SASC) was studied over the range of room temperature to 1400 deg C. The results strongly indicate that a nonelastic mechanism, probably a viscous mechanism, is contributing to the contact behavior of SASC at elevated temperatures. In addition, zirconia, which does not form a viscous layer, was studied for comparison purposes. Author (GRA)

N84-22760# Rutgers - The State Univ., New Brunswick, N. J. High Pressure Materials Research Lab.
HIGH PRESSURE MELTING AND CRYSTALLIZATION OF NYLON-11 Interim Technical Report
P. K. K. Chen, B. A. Newman, J. I. Scheinbeim, and K. D. Pae 2 Mar. 1984 22 p
(Contract N00014-75-C-0540)
(AD-A138858; TR-26) Avail: NTIS HC A02/MF A01 CSCL 11/5

Differential thermal analysis (DTA), high pressure differential thermal analysis (HP-DTA), and high temperature X-ray studies are combined to elucidate the origin of the two melting peaks in Nylon 11. The results of the studies suggest that two species of crystals are involved in the melting of Nylon 11 samples, crystallized at atmospheric pressure, when the environmental pressure is below 4 Kbars. At atmospheric pressure, the high melting species is predominant. However, under hydrostatic pressures, the high melting species undergoes phase transition to the low melting species before melting. The amount of the material involved in the transition depends on the pressure. At pressure of 4 Kbar or greater, the entire high melting species transforms to the low melting species. The melting behavior, at atmospheric pressure, of samples crystallized at high pressures also show two melting peaks if the crystallization pressure is below 4 Kbars. The amount of the low melting species increases with increasing pressure and, at 4 Kbars or higher, only melting of the low melting species is observed. The X-ray photographs taken at room temperature suggest that samples crystallized between atmospheric pressure and 3 Kbars contain both the alpha-form and the delta-form crystals but the samples crystallized at 4 Kbar and higher contain only the alpha-form crystal. However, it appears from X-ray scans taken at high temperature near melting that the low melting species is of the delta-form and the high melting species of the delta-form crystals for samples crystallized below 4 Kbars. GRA

N84-22761# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
THE CURING OF A BISPHENOL A TYPE EPOXY RESIN WITH 1,8 DIAMINO-P-MENTHANE M.S. Thesis
T. Donnellan Jun. 1982 33 p
(AD-A138977; NADC-83146-60) Avail: NTIS HC A03/MF A01 CSCL 11/9

Differential Scanning Calorimetry (DSC), Torsional Braid Analysis (TBA), and Fourier Transform Infrared Spectroscopy (FT-IR) were used to study the cure characteristics of an epoxy system which utilized a sterically hindered amine curing agents. The apparent activation energy was found to be 13.3 kCal./Mol. by DSC and 12.8 kCal./Mol. by FT-IR. Resin volatility hindered useful application of conventional TBA techniques. The resin was found to react to a partially cured (52 percent) state at room temperature and then vitrify. Samples stored for a two month period showed no advance in cure state. Subsequent application of heat caused resin devitrification and advance to a more fully cured state. The isothermal curing behavior was studied in a temperature range from 100 C to 150 C. Author (GRA)

N84-22762# Dayton Univ., Ohio. Research Inst.
HYDROLYTIC DEGRADATION OF KAPTON FILM Interim Technical Report, Jan. - Jul. 1983
D. R. Askins Wright-Patterson AFB, Ohio AFWAL Dec. 1983 61 p
(Contract F33615-82-C-5039; AF Proj. 7381; AF Proj. 2421)
(AD-A139016; UDR-TR-83-95; AFWAL-TR-83-4125) Avail: NTIS HC A04/MF A01 CSCL 11/9

An investigation of the hydrolytic degradation of Kapton polyimide film has been conducted. Tensile properties were measured on (1) unaged material, (2) material which had been immersed in water at temperatures from 50-100 deg. C for up to 5,000 hours, (3) material which had been stressed to 5,000 psi while being exposed to 95-100% relative humidity at 75 and 85 deg. C, and (4) material which had been repetively cycled through a combination of ultraviolet radiation and condensing humidity at 50-60 deg. C. The property degradation as a function of time was found to be best represented by an exponential decay curve for all exposure conditions. The immersion time required for the film to lose a prescribed percentage of its initial tensile properties was determined for each aging temperature, and these lifetimes were correlated with temperature using the Arrhenius relationship. Over the temperature range examined, excellent linearity was obtained. Following the same criteria as with the immersion specimen, lifetimes were determined for the stressed humidity exposures and ultraviolet-humidity cyclic exposures. Both of these exposure environments significantly accelerated the rate of degradation over that observed in the unstressed water immersions at equivalent temperatures. Author (GRA)

N84-22763# Air Force Packaging Evaluation Agency, Wright-Patterson AFB, Ohio. Materials Engineering Branch.
EVALUATION OF 'SORBOTHANE' CUSHIONING MATERIAL Final Report, Dec. 1982 - Jan. 1984
M. T. Wyderski Jan. 1984 16 p
(AD-A139079; DSTZT-83-R-12) Avail: NTIS HC A02/MF A01 CSCL 11/9

Sorbothane, a high density polyurethane material with unusual displacement properties, is presently used extensively as a cushioning material for the human body in medical and sporting applications. This study was undertaken to consider possible packaging applications for this unique material in providing cushioning and shock isolation for Air Force equipment. Various structural configurations of the material were subjected to dynamic cushioning evaluation. In addition the material was evaluated for its shear strength characteristics for possible use in shear mount type shock isolators. Results of this evaluation indicate that dynamic cushioning characteristics of Sorbothane are only slightly better

than some commonly used materials. The high density and cost of Sorbothane makes this material quite impractical as cushioning material in comparison with the commonly used materials. The low shear strength of Sorbothane and its tendency to tear under shear loading makes it unsuitable for use in shock isolators.
Author (GRA)

N84-22764# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
HIGH TEMPERATURE FAILURE MECHANISMS IN CERAMIC POLYCRYSTALS
A. G. Evans and W. Blumenthal Dec. 1983 24 p refs Presented at the 2nd Intern. Conf. on Creep and Fracture of Eng. Mater. and Structures, Swansea, United Kingdom, 1-6 Apr. 1984
(Contract DE-AC03-76SF-00098)
(DE84-006641; LBL-16192; CONF-8404103-1) Avail: NTIS HC A02/MF A01

The high temperature failure of ceramics which occurred by the nucleation, growth and coalescence of cracks was observed. Each process involves diffusive cavity nucleation and growth, either within a damage zone or at microstructural heterogeneities. The specific cavitation and cracking mechanisms pertinent to ceramics are described and available models are presented. Particular emphasis is placed on continuous crack nucleation at microstructural heterogeneities and the crack coalescence process that causes eventual failure. Failure time data are reviewed and correlated with models. DOE

N84-22765# California Inst. of Tech., Pasadena. Dept. of Chemical Engineering.
EFFECT OF PRESSURE ON THE MECHANICAL PROPERTIES OF POLYMERS, PART 1 Final Report
N. W. Tschoegl Feb. 1984 144 p refs
(Contract DE-AT03-76ER-75016)
(DE84-006311; DOE/ER-75016/T1) Avail: NTIS HC A07/MF A01

The free volume based FMT equation describes the superposition of stress relaxation data at high pressures. It is suspected that the free volume theory is successful because it does not consider the ill defined glassy state. The parameters derived from the Adam-Gibbs theory at atmospheric pressure do not seem appropriate for the description of relaxation at high pressure. The extension of the Simba-Somcynsky equation of state to this problem yields reasonable predictions for the polymers studied with only a single adjustable parameter. The fact that the theory provides an excellent estimate for the expansivity of the free volume answers one of the objections to the free volume theory, namely, that the free volume is too ill defined to be operationally useful. The theory predicts realistic values for the fractional free volume, its expansivity, and the proportionality factor-B in most cases, provided the parameters of the SS theory and the zero pressure WLF constants are available. DOE

N84-22766# Knolls Atomic Power Lab., Schenectady, N. Y.
CHARACTERIZATION OF ZIRCONIUM ALLOY OXIDATION FILMS BY ALTERNATING CURRENT IMPEDENCE
P. M. Rosecrans Nov. 1983 38 p refs Presented at the NACE Corrosion Intern. Forum and Exhibition, New Orleans, 1 Apr. 1984
(Contract DE-AC12-76SN-00052)
(DE84-006225; KAPL-4174; CONF-840405-9) Avail: NTIS HC A03/MF A01

Zirocnium alloy oxidation kinetics which are highly nonlinear are discussed. Electrochemical measurements and electron microscopy support the existence of porosity in oxide films formed on zirconium alloys in high temperature aqueous environments. Oxidation kinetics are related to the thickness and distribution of nonporous elements within the oxide. It is shown that both the level and distribution of porosity within the oxide factor into oxidation kinetics. The barrier layer model can provide a basis for predicting the effect of environmental changes on oxidation rate and it demonstrates the need for further research into porosity generation mechanisms in oxide films. DOE

N84-22767# Rolls-Royce Ltd., Derby (England).
HIGH TEMPERATURE ADHESIVES FOR STRUCTURAL APPLICATIONS: A REVIEW
J. R. Fowler 1 Dec. 1982 15 p refs Presented at Ind. Appl. of Adhesives Seminar, 10 Nov. 1982; sponsored by Institution of Production Engineers and Design Council
(PNR-90171; Reprint-873) Avail: NTIS HC A02/MF A01

The requirement for high temperature adhesives in the aero engine industry is assessed and the reasons for the choice of polyimide adhesives as prime candidates are outlined. Cure chemistry of these resins is described and the development of polyimides that cure by addition mechanisms is reviewed. Adhesives are listed and two typical formulations (FM34 and A7F) are discussed, giving as-cured and thermally aged properties. The necessity for the provision of special accessory materials and curing facilities to process these adhesives at the required temperatures is explained. Author (ESA)

N84-22804# Joint Publications Research Service, Arlington, Va.
APPROACH TO SOLVING PROBLEM OF ACOUSTIC WAVE DIFFRACTION BY ELASTIC SHELL Abstract Only
O. V. Vlzhiyevskaya *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 23 Transl. into ENGLISH from Dokl. Akad. Nauk Ukr. SSR Ser. A: Fiz.-Mat. i Tekhn. Nauki (Kiev), no. 11, Nov. 1983 p 31-35 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

N84-23225# Joint Publications Research Service, Arlington, Va.
QUALITIES OF SEP CERAMIC-CERAMIC CERASEP COMPOSITES
M. B. Malassine *In its* West Europe Rept.: Sci. and Technol. (JPRS-WST-84-011) 9 Apr. 1984 p 1-3 Transl. into ENGLISH from Ing. Automob. (France), Nov.-Dec. 1983 p 77-78 (For primary document see N84-23224 13-70)
Avail: NTIS HC A03/MF A01

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers; storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N84-22768*# E-F Technology, Inc., St. Johns, Mich.
STUDY OF SYSTEMS AND TECHNOLOGY FOR LIQUID HYDROGEN PRODUCTION INDEPENDENT OF FOSSIL FUELS Final Report
Robert J. Sprafka, William J. D. Escher, Richard W. Foster, Raymond R. Tison, Jefferson Shingleton, James S. Moore, and Charles R. Baker Aug. 1983 258 p refs
(Contract NAS10-10541)
(NASA-CR-173422; NAS 1.26:173422) Avail: NTIS HC A12/MF A01 CSCL 21D

Based on Kennedy Space Center siting and logistics requirements and the nonfossil energy resources at the Center, a number of applicable technologies and system candidates for hydrogen production were identified and characterized. A two stage screening of these technologies in the light of specific criteria identified two leading candidates as nonfossil system approaches. Conceptual design and costing of two solar-operated, stand alone systems, one photovoltaic based on and the other involving the power tower approach reveals their technical feasibility as sited as KSC, and the potential for product cost competitiveness with conventional supply approaches in the 1990 to 1210 time period. Conventional water hydrolysis and hydrogen liquefaction subsystems are integrated with the solar subsystems. A.R.H.

N84-22769# Pratt and Whitney Aircraft of Canada Ltd., Mississauga (Ontario).
ALTERNATE FUELS COMBUSTION RESEARCH Interim Report,

19 May 1980 - 20 Feb. 1983
M. Gratton and P. Sampath Oct. 1983 197 p
(Contract F33615-80-C-2002; AF Proj. 3048)
(AD-A138575; AFWAL-TR-83-2057) Avail: NTIS HC A09/MF A01 CSCL 21/4

This report presents the results of the Can Combustor Test Phase (Phase II) of the Alternate Fuels Combustion Research Program. The effects of variations in fuel properties on the performance characteristics of a small can combustion system were determined. Fifteen different fuels were used, encompassing a wide range of chemical and physical properties. The tests covered current specification, broadened specification and alternate source (shale and tar sands derived) fuels. Combustor rig tests were performed to determine the effects of fuel properties on stability, low temperature light-offs, gaseous emissions, smoke emissions, metal temperatures and radiation heat loads. Attempts were also made to characterize fuel nozzle contamination and carbon formation, but these tests were somewhat inconclusive. Based on test results from can combustor tests, a test plan was formulated for testing PT6 and JT15D reverse-flow annular combustors. GRA

N84-22770# Air Force Academy, Colo. Research Lab.
RESEARCH INTO THE THERMAL DECOMPOSITION OF SELECTED ENERGETIC MATERIAL CANDIDATES (PROJECT ORDER ATL-2-094) Final Technical Report, 1 Oct. 1981 - 30 Sep. 1982
S. R. Bosco and R. C. Dorey Dec. 1983 16 p
(AF Proj. 2303)
(AD-A138730; FJSRL-TR-83-0018) Avail: NTIS HC A02/MF A01 CSCL 19/1

The thermal decomposition of current and future energetic materials has been studied by electron paramagnetic resonance spectroscopy. The results of this study indicate that certain of these materials exhibit radical spectra when they decompose while others do not; in some cases, there is no evidence for decomposition at up to 250 C. GRA

N84-22638# Purdue Univ., Lafayette, Ind. School of Aeronautics and Astronautics.
AN OPTICAL SURFACE TRACKING DEVICE WHICH DETERMINES A SOLID PROPELLANT'S BURNING RATE
R. A. Frederick, Jr., J. C. Matson, and A. R. Weston (AFRPL) *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 51-60 refs (For primary document see N84-22632 13-20)
Avail: NTIS HC A99/MF A01 CSCL 21/9

N84-22646# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
EFFECT OF OSCILLATIONS UPON VELOCITY DISTRIBUTIONS IN SIMULATED SOLID PROPELLANT FLOW ENVIRONMENTS
F. L. Chen (NPU), B. R. Daniel, and B. T. Zinn *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 161-168 refs (For primary document see N84-22632 13-20)
(Contract F49620-82-C-0013)
Avail: NTIS HC A99/MF A01 CSCL 21/9

N84-22649# Pennsylvania State Univ., University Park. Dept. of Aerospace Engineering.
DIRECT MEASUREMENT OF HIGH FREQUENCY SOLID PROPELLANT RESPONSE FUNCTIONS
J. R. Wilson and M. M. Micci *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 193-202 refs (For primary document see N84-22632 13-20)
(Contract F04611-82-K-0063)
Avail: NTIS HC A99/MF A01 CSCL 21/9

N84-22650# Morton Thiokol, Brigham City, Utah.
ACOUSTIC AND PHOTOELECTRIC BURNOUT DETECTION OF T-BURNER GRAINS
D. P. Clark and T. D. Moore *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 203-206 (For primary document see N84-22632 13-20)
Avail: NTIS HC A99/MF A01 CSCL 21/9

N84-22653# Georgia Inst. of Tech., Atlanta.
DEPENDENCE OF BURNING RATE OF AP-POLYMER SANDWICHES ON THICKNESS OF THE BINDER LAMINAE
Edward W. Price and Jayaraman K. Sambamurthi *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 223-234 refs (For primary document see N84-22632 13-20)
(Contract N00014-79-C-0764)
Avail: NTIS HC A99/MF A01 CSCL 21/9

N84-22654# Purdue Univ., Lafayette, Ind. School of Aeronautics and Astronautics.
EFFECT OF NON-CONSTANT SOLID PHASE THERMAL PROPERTIES ON TEMPERATURE SENSITIVITY OF SOLID PROPELLANT
J. P. Renie, M. S. Geyer, and J. R. Osborn *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 235-238 refs Sponsored in part by Morton Thiokol, Inc. (For primary document see N84-22632 13-20)
Avail: NTIS HC A99/MF A01 CSCL 21/9

N84-22655# Aberdeen Proving Ground, Md.
STATUS OF AMMONIUM NITRATE IN PROPELLANTS AND EXPLOSIVES
Indu B. Mishra (Olin Corp.), Russell Reed (Naval Weapons Center), Eugene Pacanowsky, and Larry VandeKieft *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 239-262 (For primary document see N84-22632 13-20)
Avail: NTIS HC A99/MF A01 CSCL 21/9

N84-22656# Princeton Combustion Research Labs., Inc., N.J.
ASYMPTOTIC CONDENSED PHASE ANALYSIS OF DEFLAGRATING MONOPROPELLANTS WITH SUBSURFACE EXOTHERMICITY
Moshe Ben-Reuven *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 263-280 refs (For primary document see N84-22632 13-20)
(Contracts AFOSR-MIPR-81-0004; DAAK11-80-C-0104)
Avail: NTIS HC A99/MF A01 CSCL 21/9

N84-22657# Naval Weapons Center, China Lake, Calif.
CONDENSED PHASE TEMPERATURE PROFILES IN DEFLAGRATING HMX
D. M. Parr and T. P. Parr *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 281-292 refs (For primary document see N84-22632 13-20)
Avail: NTIS HC A99/MF A01 CSCL 21/9

N84-22659# Naval Postgraduate School, Monterey, Calif.
AN INVESTIGATION OF EXPERIMENTAL TECHNIQUES FOR OBTAINING PARTICULATE BEHAVIOR IN METALLIZED SOLID PROPELLANT COMBUSTION
R. G. Cramer, R. J. Edington, D. E. Faber, K. J. Graham, B. J. Hansen, P. J. Hickey, L. A. Klooster, P. J. Mellin, J. P. Powers, and D. W. Metzer *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 319-332 refs (For primary document see N84-22632 13-20)
(Contracts F04611-82-X-0008; F04611-83-X-0010)
Avail: NTIS HC A99/MF A01 CSCL 21/9

N84-22660# Georgia Inst. of Tech., Atlanta.
CONDITIONS FOR INFLAMMATION OF ACCUMULATED ALUMINUM IN THE PROPELLANT COMBUSTION ZONE
E. W. Price, J. K. Sambamurthi, R. K. Sigman, and T. S. Sheshadri *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 333-342 refs (For primary document see N84-22632 13-20)
(Contract F49620-82-C-0013)
Avail: NTIS HC A99/MF A01 CSCL 21/9

N84-22661# Morton Thiokol, Brigham City, Utah.
COMBUSTION OF HIGH-ALUMINUM-CONTENT PROPELLANTS
Winston N. Brundige *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 343-350 refs (For primary document see N84-22632 13-20)
Avail: NTIS HC A99/MF A01 CSCL 21/9

N84-22664# Ballistic Research Labs., Aberdeen Proving Ground, Md.
SLOTTED STICK PROPELLANT STUDY
F. W. Robbins and A. W. Horst *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 377-386 refs (For primary document see N84-22632 13-20)
Avail: NTIS HC A99/MF A01 CSCL 21/9

N84-22665# Army Armament Munitions and Chemical Command, Dover, N.J.
CLOSED VESSEL COMBUSTION STUDIES OF STICK PROPELLANT
Donald Chiu, Aaron Grabowskiy, and David Downs *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 393-402 refs (For primary document see N84-22632 13-20)
Avail: NTIS HC A99/MF A01 CSCL 21/9

N84-22667# Ballistic Research Labs., Aberdeen Proving Ground, Md.
CLOSED BOMB COMBUSTION SIMULATION OF HIVELITE SOLID PROPELLANT
Douglas E. Kooker and Ronald D. Anderson *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 427-446 refs (For primary document see N84-22632 13-20)
Avail: NTIS HC A99/MF A01 CSCL 21/9

N84-22668# Ballistic Research Labs., Aberdeen Proving Ground, Md.
EFFECT OF FABRICATION TECHNIQUES ON CONSOLIDATED CHARGE BURNING
J. O. Doali, A. A. Juhasz, R. E. Bowman, and W. P. Aungst *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 447-462 refs (For primary document see N84-22632 13-20)
Avail: NTIS HC A99/MF A01 CSCL 21/9

N84-22674# Army Research and Development Command, Dover, N.J.
MOLECULAR DYNAMICS OF PROPELLANT GASES
T. Vladimiroff *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 505-510 refs (For primary document see N84-22632 13-20)
Avail: NTIS HC A99/MF A01 CSCL 21/9

N84-22675# Ballistic Research Labs., Aberdeen Proving Ground, Md.
THE THERMODYNAMICS OF REAL AND UNREAL BLACK POWDER
Eli Freedman *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 511-518 refs (For primary document see N84-22632 13-20)
Avail: NTIS HC A99/MF A01 CSCL 21/9

N84-22676# Tally Industries, Inc., Mesa, Ariz.
INVESTIGATION OF ORGANIC OXIDIZERS FOR HIGH PERFORMANCE LOW FLAME TEMPERATURE GAS GENERATOR APPLICATIONS
M. L. Moore, P. H. Graham, and N. H. Lundstrom (Lundstrom Technical Services, Tacoma, Wash.) *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 519-528 refs (For primary document see N84-22632 13-20)
Avail: NTIS HC A99/MF A01 CSCL 21/9

N84-22677# Pennsylvania State Univ., University Park. Dept. of Mechanical Engineering.
NITRAMINE PROPELLANT IGNITION UNDER RAPID GAS LOADING CONDITIONS
S. Yu, W. H. Hsieh, and K. K. Kuo *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 529-546 refs (For primary document see N84-22632 13-20)
Avail: NTIS HC A99/MF A01 CSCL 21/9

N84-22679# Ballistic Research Labs., Aberdeen Proving Ground, Md.
MULTIPHASE FLOW ANALYSIS OF THE BALLISTIC PERFORMANCE OF AN ANOMALOUS LOVA PROPELLANT MIX
Albert W. Horst *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 557-570 refs (For primary document see N84-22632 13-20)
Avail: NTIS HC A99/MF A01 CSCL 21/9

N84-22680# Air Force Rocket Propulsion Lab., Edwards AFB, Calif.
DEUTERIUM ISOTOPE EFFECTS IN HMX THERMOCHEMICAL MECHANISMS: DECOMPOSITION, DEFLAGRATION, AND COMBUSTION
S. A. Shackelford, M. B. Coolidge, B. B. Goshgarian, R. N. Rogers (LASL), J. L. Janney (LASL), M. H. Ebinger (LASL), D. A. Flanigan (Morton Thiokol, Inc., Huntsville, Ala.), and R. E. Askins (Morton Thiokol, Inc., Huntsville, Ala.) *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 571-580 refs (For primary document see N84-22632 13-20)
Avail: NTIS HC A99/MF A01 CSCL 21/9

N84-22681# Ballistic Research Labs., Aberdeen Proving Ground, Md.
KINETICS OF THE BETA + DELTA PHASE TRANSFORMATION OF HMX
Robert A. Fifer *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 581-590 refs (For primary document see N84-22632 13-20)
Avail: NTIS HC A99/MF A01 CSCL 21/9

N84-22682# Naval Weapons Center, China Lake, Calif.
MODELING THE SELF-DEFLAGRATION OF HMX
C. F. Price and T. L. Boggs *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 591-600 refs (For primary document see N84-22632 13-20)
Avail: NTIS HC A99/MF A01 CSCL 21/9

N84-22684# Ballistic Research Labs., Aberdeen Proving Ground, Md.
COMBUSTION THERMODYNAMICS OF SOME BORON-NITROGEN-HYDROGEN COMPOUNDS
Robert A. Fifer and Irvin C. Stobie *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 611-620 refs (For primary document see N84-22632 13-20)
Avail: NTIS HC A99/MF A01 CSCL 21/9

N84-22685# Lockheed Missiles and Space Co., Palo Alto, Calif.
MODELING EFFECTS OF COMPOSITION ON THE BURN RATES OF NITRATE ESTER-BASED ENERGETIC BINDERS
N. S. Cohen and C. A. Lo *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 621-628 refs Prepared in cooperation with Cohen (Norman) Professional Services, Redlands, Calif. (For primary document see N84-22632 13-20)
Avail: NTIS HC A99/MF A01 CSCL 21/9

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N84-22771*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AERONAUTICS AND SPACE ENGINEERING BOARD: AERONAUTICS ASSESSMENT COMMITTEE
1977 263 p refs Meeting held 16-17 Mar. 1977
(NASA-TM-85594; NAS 1.15:85594) Avail: NTIS HC A12/MF A01 CSCL 13B

High temperature engine materials, fatigue and fracture life prediction, composite materials, propulsion noise pollution, propulsion components, full-scale engine research, V/STOL propulsion, advanced engine concepts, and advanced general aviation propulsion research were discussed. B.G.

N84-22772# Joint Publications Research Service, Arlington, Va.
USSR REPORT: ENGINEERING AND EQUIPMENT
17 Apr. 1984 34 p refs Transl. into ENGLISH from various Russian articles
(JPRS-UEQ-84-004) Avail: NTIS HC A03/MF A01

This serial report contains news items, abstracts and articles of scientific reports on aspects of engineering and equipment including industrial technology, high-energy devices, optics, photography, fluid mechanics, mechanics of solids, and testing and materials. For individual titles, see N84-22773 through N84-22808.

N84-22773# Joint Publications Research Service, Arlington, Va.
FEASIBILITY ANLYSIS OF NOVEL TECHNOLOGICAL PRINCIPLES OF PRODUCING MULTICOMPONENT MECHANISMS Abstract Only
V. N. Lymzin and A. M. Rostovtsev *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 1 Transl. into ENGLISH from Mashinovedeniye (Moscow), no. 5, Sep. - Oct. 1983 p 56-63 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

Structural analysis of technological processes by the graph method and based on the concept of technological state is applied to a feasibility study of principles of producing multicomponent mechanisms for accurate performance under operating conditions. A state is defined as a condition in which the quality indicators, specifically the geometrical precision, retain their levels attained in preceding stages or transitions in the process. Each technological operation is described by a directional graph, with both sequential and parallel transformations of technological states from one to another included. Dimensional errors are calculated with the aid of a corresponding transformation matrix, whereupon an error compensation chart is drawn which biases the manufacturing variance of geometrical parameters so as to compensate errors caused by influencing factors in service and their deviation from normal delivery acceptance level. These influencing factors are grouped into five categories: (1) ambient temperature; (2) force actions; (3) diffusion; (4) destructive actions; (5) radiation effects.
Author

N84-22774# Joint Publications Research Service, Arlington, Va.
DYNAMIC STIFFNESS OF CLOSED GAS-STATIC BEARING WITH REGULATOR Abstract Only **c37**
Yu. A. Shukholutskiy, G. Kh. Ingert, and B. G. Lurye *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 2 Transl. into ENGLISH from Mashinovedeniye (Moscow), no. 6, Nov. - Dec. 1983 p 105-109 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

The performance of a closed gas static bearing with a regulator which includes a swinging baffle is analyzed for dynamic stiffness. The regulator consists of a pressure chamber between a base plate and a cover plate with hermetic sealing and a baffle plate mounted on torsion bars inside. The baffle plate is slotted and acts as a valve which adjusts the bearing pressure during load fluctuations. The performance is analyzed on the basis of the corresponding equations of dynamics for the baffle plate in such a regulator, assuming symmetry of orifice and throttle nozzles through the regulator base plate as well as symmetry of clearances in the regulator and in the bearing respectively. The transfer function of this closed loop system is determined from this system of equations after linearization and Laplace transformation. The results of analysis reveal that the dynamic stiffness depends not only on the frequency of regulator action, dropping to a minimum at some low frequency, but also on the volume of compressible fluid in that it decreases as the latter is made larger. Author

N84-22775# Joint Publications Research Service, Arlington, Va.
IMPROVEMENT OF DYNAMIC CHARACTERISTICS OF GAS-STATIC BEARINGS Abstract Only **c37**
S. N. Shatokhin and V. A. Kodnyanko *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 2-3 Transl. into ENGLISH from Mashinovedeniye (Moscow), no. 6, Nov. - Dec. 1983 p 100-104 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

Gas static bearings with compensation of gas discharge by means of plain or annular throttling diaphragms are considered, each type of diaphragm offering some advantages and drawbacks. Improvement of the static as well as dynamic characteristics by combining the advantages of both types is sought and found in theory on the basis of the mathematical model of an open axial bearing with double throttling. The equation of flow rate balance is formulated in the Prandtl approximation of a nonisentropic process and disregarding the effect of gas compressibility in pockets. The static characteristics and the dynamic quality criteria are established in terms of the pressure distribution in the gaseous carrier layer, this pressure distribution function being determined from the solution to the corresponding boundary value problem for the Reynolds equation of nonsteady flow with small deviations of the movable bearing element from its equilibrium position.
Author

N84-22776# Joint Publications Research Service, Arlington, Va.
CONTROLLER FOR THE ELECTRO-OPTICAL SHUTTER OF A DUAL PULSE LASER Abstract Only **c36**
M. A. Muravitskiy and V. M. Borshchyevskiy *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 4 Transl. into ENGLISH from Pribory i Tekhn. Eksperimenta (Moscow), no. 5, Sep. - Oct. 1983 p 221 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

A unit for controlling the cavity Q of a dual pulse laser utilizes the independent discharging of two high voltage capacitors in an electro-optical shutter. The capacitors are charged to a voltage of 0.5 to 15 KV. The controller contains three regulated power supplies: two for the capacitors and a 0 to 12 KV DC bias supply for the shutter. The high voltage switchers in the controller are controlled from any industrial dual channel square wave generator with an output amplitude of 10 V or more (for example, a G5-56). The output pulse amplitude is continuously variable from 0.5 to 15 KV; the bias voltage is continuously variable from 0 to 12 KV; the rise time of the pulses is no more than 0.5 KV/ns. The minimum delay between the pulses is 0.1 microsecond. The maximum switching frequency is 3 Hz. The controller is powered from the AC mains at 220 V, 50 Hz with a power consumption of 450 W. The dimensions are 510 x 500 x 310 mm and the weight is 30 kg.
Author

N84-22777# Joint Publications Research Service, Arlington, Va.
PROCEDURE FOR WALL TEMPERATURE MEASUREMENT IN A METAL VAPOR LASER Abstract Only **c36**
L. B. Direktor, A. V. Karasev, M. M. Malikov, and S. N. Skovorodko *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 4-5 transl. into ENGLISH from Pribory i Tekhn. Eksperimenta (Moscow), no. 5, Sep. - Oct. 1983 p 191-192 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

The wall temperature of high temperature laser chambers using metal vapors is measured without shutting down the pumping source by passing the beam through an interrupter to an optical pyrometer. This optical chopper consists of a rotating and a stationary disc with holes in them. Synchronization is accomplished by shining another light source through the holes in the rotating disc onto a photodetector, in order to produce signals which trigger the pumping source. These signals are generated in a coincidence gate, which uses a master oscillator as a reference standard. The pulse frequency in the pulse train triggering the pumping source and the pulse width are set by the master oscillator; durations of the pulse train and the pauses are determined by the disc rotational speed, the size of the holes as well as the number of holes. Since the repetition rate of the discharge pauses was approximately 70 Hz, the observer sees the continuous luminescence of the chamber walls in the pyrometer ocular by virtue of the persistence of vision.
Author

N84-22778# Joint Publications Research Service, Arlington, Va.
HOLLOW CATHODE CELL FOR PULSED LASERS USING METAL VAPORS AND THEIR CHEMICAL COMPOUNDS Abstract Only **c36**
V. Yu. Fuchko, V. A. Kelman, and I. P. Zapesochnyy *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 5-6 Transl. into ENGLISH from Pribory i Tekhn. Eksperimenta (Moscow), no. 5, Sep. - Oct. 1983 p 189-190 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

A discharge in a hollow cathode is an efficient means of producing inversion and lasing with the ion transitions of metals. A hollow cathode, which is a stainless steel tube 3 mm in diameter and 35 cm long has 8 holes spaced 4 cm apart with diameters of 3 mm. The cathode is enclosed in a quartz envelope with holes corresponding to the cathode holes. The sectional anode was made in the form of individual stubs positioned at a distance of 12 mm from the corresponding holes in the cathode. The entire cell was placed in an asbestos jacket with a heating element. The pulsed supply provided a current pulse repetition rate of from 0.04 to 12.5 KHz, producing a stable discharge with the hollow cathode effect at a gas pressure of 1 to 150 mm Hg and a current of up to 100 A. The current pulse width at the base was 0.8 microseconds under typical conditions. Lasing was studied via Cd ion transitions using mixtures of He+Cd and He+CdBr2. Vapors are produced at temperatures up to 900 C. The configuration of the hollow cahode cell and the pulse discharge generator is drawn; the lasing power at the 441.6 nm line in a He+Cd mixture is plotted as a function of the current pulse amplitude, showing a peak around 8 A. Author

N84-22779# Joint Publications Research Service, Arlington, Va.
UTILIZING LIGHT FOCUSING BY GAS DISCHARGE MEDIUM FOR STABILIZATION OF EMISSION POWER OF He-Ne LASER AT WAVELENGTH OF 6401 ANGSTROMS Abstract Only **c36**
D. N. Gavrilov, E. M. Rabinovich, and V. V. Tuchin *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 7 Transl. into ENGLISH from Pribory i Tekhn. Eksperimenta (Moscow), no. 5, Sep. - Oct. 1983 p 187-188 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

Emission from an He-Ne laser operating in the lowest transverse mode at a wavelength of 6,401 A passes through a gas discharge cell and a stop which are positioned in series along the laser beam axis. A portion of the radiation is routed to a photodiode in a feedback loop by a semitransparent mirror. The photodiode output is amplified and fed to a discharge circuit of the gas discharge cell. The focusing properties of the discharge and the size of the laser beam spot in the diaphragm stop plane change as a function of the discharge current in the cell. The phase of the signal in the feedback loop is chosen so that an increase in laser power is accompanied by an increase in the emission spot size and a power decrease reduces the diameter of the laser beam. A methane cell is placed in the laser to suppress the 3.39 micrometer lasing. This scheme effectively suppressed output power fluctuations up to frequencies of about 30 KHz. Author

N84-22780# Joint Publications Research Service, Arlington, Va.
EXPERIENCE WITH DEVELOPMENT OF SEALED LINEAR WAVEGUIDE ELECTRON ACCELERATORS Abstract Only **c33**
Ye. V. Suvorov and A. I. Khaustov *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 7 Transl. into ENGLISH from Pribory i Tekhn. Eksperimenta (Moscow), no. 5, Sep. - Oct. 1983 p 11-13 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

A sealed linear electron accelerator eliminates the need for vacuum pumps, valves, flanges and similar hardware, making it the only acceptable design for such geophysical applications as well as logging. A sealed accelerator tube used as a transportable gamma radiation source is described. Ten such tubes were built. The first models had vacuum gauges to monitor the internal pressure; it ranged between .00001 and .000001 n/sq m. The MTBF was more than 500 hours. The accelerator has an electron energy of 6 to 7 MeV with a pulsed current of 20 to 20 mA when driven by a 3 cm band transmitter with a pulse power of 500 KW; the accelerator weighs 9 kg, has an overall length of 2,300 mm and a maximum diameter of 88 mm. Because there are no external lines and pumps, the prestart time was reduced to 3 to 5 minutes. The high vacuum allows the use of an oxide cathode having a large current density which reduces the electron beam diameter and facilitates its focusing. A drawing of the sealed accelerator tube is shown along with a graph plotting the temperature, pressure and gas fow as a function of time during the thermal vacuum sealing of the accelerator tube. Author

N84-22781# Joint Publications Research Service, Arlington, Va.
TELEVISION SYSTEM FOR MONITORING TARGET POSITION IN LASER THERMONUCLEAR FUSION EXPERIMENTS Abstract Only **c75**
B. L. Vasin, A. D. Valuyev, O. L. Goryachuk, A. Ye. Danilov, R. G. May, G. V. Sklizkov, S. I. Fedotov, and S. A. Chaushanskiy *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 7-8 Transl. into ENGLISH from Pribory i Tekhn. Eksperimenta (Moscow), no. 5, Sep. - Oct. 1983 p 160-162 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

A four-channel TV system was developed for monitoring the positioning of working thermonuclear fusion targets in three dimensions with an error of + or - 5 micrometers. A target at a distance of from 250 to 350 mm is located in a spatial volume of 10 x 10 x 10 x 10 mm with a magnification of 17; it is set in three coordinates relative to a specified point in a volume of 1 x 1 x 1 mm with a magnification of 250. The configuration of the system using an He-Ne laser is diagrammed and discussed. The spherical targets have diameters of 50 to 800 micrometers. The spatial resolution in the target setting mode is 62 lines/mm. The ultimate magnification of the system is 500; photographs of TV images of polystyrene and glass targets are shown. Author

N84-22782# Joint Publications Research Service, Arlington, Va.
MINIATURIZED PULSED CO2 LASER WITH SEALED ELECTRON SOURCE Abstract Only **c36**
Yu. I. Bychkov, V. M. Orlovskiy, V. V. Osipov, and A. G. Poteryayev *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 8 Transl. into ENGLISH from Pribory i Tekhn. Eksperimenta (Moscow), no. 5, Sep. - Oct. 1983 p 185-186 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

A new miniature electron beam-controlled CO2 laser (the MIG-3) contains an electron accelerator, gas cell and DC supply in one large unit (0.22 x 0,16 x 0.7 m) and the accelerator power supply and laser control panel in a second smaller unit. The overall weight of the instrument in 30 kg. The electron beam is controlled by four vacuum diodes in parallel; a 180 KV pulse is fed to the vacuum diode inputs from a 'NORA' series-produced X-ray source (the MIRA-3D) also is used). The total electron beam current from all diodes was 600 A following the foil with a half-height width of 10 ns. The lasing medium is CO2:N2 - 1:1 at 4.5 atm. The maximum stimulated emission pulse energy was 1 J with an efficiency of 8% when the pressure was 4 atm. With a pulse repetition rate of 4 Hz, the average power consumption of the unit was 100 W.
Author

N84-22783# Joint Publications Research Service, Arlington, Va.
CENTRAL BURST OF SIMULTANEOUSLY ROTATING AND GRAVITATING BODY Abstract Only **c90**
A. N. Golubyatnikov and T. I. Chilachava *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 9 Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 273, no. 4, Dec. 1983 p 825-829 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

The astrophysical problem of bursts in simultaneously rotating and gravitating celestial bodies is treated as an axisymmetric one

for a homogeneous ellipsoid bursting at the center. It is formulated in a system of spherical coordinates with the sought distributions of pressure and gravitational potential appropriately stipulated. The corresponding equations of steady axisymmetric adiabatic motion of a gas during the initial stage, before the shock wave reaches the surface, are formulated in Lagrange variables and by the asymptotic method of a thin shock layer with epsilon = upsilon -1 as the small parameter upsilon- adiabatic exponent) and with appropriate boundary conditions at the shock wave front. Consideration is taken of the law of momentum conservation and the condition of continuity for the tangential velocity component as well as for Euler and Lagrange variables. Emergence of the shock wave at the body surface, at the poles first, results in formation of jets associated with expansion of a gas into vacuum. R.J.F.

N84-22784# Joint Publications Research Service, Arlington, Va.
SEPARATION FLOW PAST BODIES WITH FIXED SEPARATION SITES Abstract Only **c34**
O. M. Belotserkovskiy, S. M. Belotserkovskiy, Yu. M. Davydov, and M. I. Nisht *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 10 Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), no. 4, Dec. 1983 p 821-825 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

Separation flow past bodies was studied by way of computer experiments. Flow in a continuous medium at a high Reynolds number (Re = 100,000-ten to the 7th power) was simulated on the basis of Euler equations for nonsteady flow of an ideal medium and by two fundamentally different methods. The method of discrete vortices was used for solving nonlinear steady-state and transient-state equations applicable to bodies in incompressible media. This method yielded reliable results in analysis of flow past carrier surfaces with vortex trails, plane flow with initial Prandtl or Karman vortex trail behind plates, plane flow with mixing and rotation in vane cascades, three-dimensional flow with acceleration past bodies made of permeable materials, and three-dimensional flow with transformation of vortex sheet into vortex filaments at wings. The method of large particles was used for flow of a gas at subsonic and supersonic velocities, plane axisymmetric flow, and three-dimensional flow with vortex spirals. The results obtained by both methods were verified by other mathematical methods. R.J.F.

N84-22785# Joint Publications Research Service, Arlington, Va.
DISCHARGE OF IDEAL GAS INTO VACUUM Abstract Only **c34**
S. P. Bautin and S. L. Deryabin *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 10-11 Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 273, no. 4, Dec. 1983 p 817-820 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

Three-dimensional nonisentropic flow of an ideal gas adjoining a vacuum or occurring upon instantaneous removal of a solid barrier which separates it from a vacuum is analyzed as a problem of decaying discontinuity. The solution to the corresponding system of three vector equations of motion and the equation of state, using the function sigma =sigma sub O(x)=p 1/2 (upsilon) (p-density of gas, upsilon > 1), is sought in the form of special converging series. A convergence test reveals that the gas particles move along straight lines at constant velocity until infinite gradients of gas-dynamic parameters build up at the vacuum boundary. Four theorems are proved pertaining respectively to the existence of a unique analytical solution in the vicinity of the discontinuity surface, to its convergence region, to the constant velocity transient following the decay of the discontinuity, and to the corresponding Cauchy problem. The proof of the first theorem reduces to an analog of the proof of the Cauchy-Kowalewska theorem and it yields a lemma pertaining to the coefficients and exponents in the series. R.J.F.

N84-22786# Joint Publications Research Service, Arlington, Va.
MORE PRECISE NUMERICAL SIMULATION OF TRANSSONIC FLOW THROUGH PASSAGES IN TURBOMACHINES Abstract Only **c02**
M. D. Krementskiy and R. M. Yablonik *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 11 Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved.: Energetika (Minsk), no. 12, Dec. 1983 p 63-67 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

A method of solving boundary-value problems in gas dynamics by numerical simulation is proposed which retains the equations of motion in a rigorously conservative form even in any nonstationary system of curvilinear coordinates. It is based on transforming the fundamental system of equations for an ideal gas in divergence form from a stationary Cartesian system of coordinates to a moving system of curvilinear coordinates by tensor formalism. The main feature of this system of equations in the new form is that the momentum equation was projected onto the axes of the original Cartesian system and thus absolute Cartesian components of the velocity vector were selected as unknown functions. Any other choice of projections would detract from the rigorous conservatism and consequently degrade the numerical simulation. For illustration, the flow through passages between blades in a ring array of an axial turbine is described in this way in a system of curvilinear coordinates moving with the blades. Description of a three-dimensional flow is derived as a special case. R.J.F.

N84-22787# Joint Publications Research Service, Arlington, Va.
EFFECT OF ROTATION ON THERMAL STATE OF RUNNER BLADE THROUGH EFFECT ON HEAT TRANSFER ON COOLANT SIDE Abstract Only **c07**
V. Y. Mityakov and V. V. Ris *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 12 Transl. into ENGLISH from Teploenerg. (Moscow), no. 1, Jan. 1983 p 51-52 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

An experimental study and subsequent analysis established that rotation of the runner blades in high-temperature gas turbines, throught action of the Coriolis force, produces secondary flow in the passages and thus affects the heat transfer from blades to coolant. This is indicated by the profile of local heat transfer coefficients, which changes with a tendency to flatten along and around the blade as the Rossby number increases. This conclusion was verified on a GTZ-150 gas turbine running at 3000 rpm and operating at an inlet temperature of 1000 K, with 0.16 kg/s of cooling air at 473 K and 1.02 MPa for each blade. The heat transfer on the coolant side can be described either by the relation Nu = 0.021Re0.8Pr0.43 disregarding the effect of rotation of rotation or by the relation Nu sub w/Nu sub O = 1 - 1.55 cost Ro-0.56 (Re = idem approximately equals 10,000, Ro approximately 20) including the effect of rotation. R.J.F.

N84-22788# Joint Publications Research Service, Arlington, Va.
THERMAL CHARACTERISTICS OF PLASMA REACTORS WITH CYLINDRICAL AND CONICAL MULTIJET MIXING CHAMBERS Abstract Only **c75**
I. S. Burov, Ye. M. Yermolayeva, V. K. Zabrodin, and A. L. Mosse *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 12 Transl. into ENGLISH from Vestsi Akad. Nauk BSSR: Ser. Fiz.-Enerhetychnykh Navuk (Minsk), no. 4, Oct. - Dec. 1983 p 85-88 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

An experimental study of plasma reactors was made for a comparative efficiency analysis of cylindrical and conical mixing chambers. Also determined were the heat losses to electrodes in the electric-arc heater and to walls of the multijet mixing chamber, both depending on the input power and the mode (tangential or radial) of plasma jet injection. The resuls reveal that the efficiency of any mixing chamber increases with increasing enthalpy of the gas and, at constant enthalpy, with increasing gas flow rate. The higher effiiency of a conical mixing chamber, despite the larger radial temperature gradient, is attributed to a thicker thermal boundary layer. Also yielded was data on the motion of disperse

silica in gaseous suspension axially injected into the mixing chamber. Experimental data on heat transfer from hot plasma to reactor chamber can be generalized by the relation St = ARe(m)Pr (-0.67), with m = 0.66 and A = 1.012 for conical chambers or A = 1.7 for cylindrical ones. R.J.F.

N84-22789# Joint Publications Research Service, Arlington, Va.
EFFECT OF HYDROMECHANICAL INERTIA FORCES ON STABILITY OF CYLINDRICAL HYDRODYNAMIC BEARING Abstract Only c37
K. P. Andreychenko *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 13 Transl. into ENGLISH from Mashinostr. (Moscow), no. 5, Sep. - Oct. 1983 p 96-102 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

The stability of a hydrodynamic bearing under inertia forces as well as viscous and body forces is analyzed on the basis of the complete corresponding equations of hydrodynamics. This system of three partial differential equations is formulated on dimensionless variables for a cylindrical inner race supported by a layer of incompressible fluid. They are solved, upon introduction of the new radial coordinate r - R sub 2 (R sub 2-outside radius of inner race) and the average velocity <V>. Double integration yields the reaction of the supporting fluid layer and the condition for stability in terms of race geometry and density, also the stability limit under vertical acceleration. The theoretical results were verified experimentally on an inner race rotating at a constant speed about a fixed axis. Heavy races were found to become self-excited into oscillations together with the fluid, in the form of a half-speed vortex. R.J.F.

N84-22790# Joint Publications Research Service, Arlington, Va.
EXACT SOLUTION TO PROBLEM OF INTERACTION BETWEEN WEDGE MOVING AT SUPERSONIC VELOCITY AND INTERFACE OF TWO GASEOUS MEDIA Abstract Only c02
R. Y. Tugazakov *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 13 Transl. into ENGLISH from Zh. Prikl. Mekhan. Tekhn. Fiz. (Novosibirsk, USSR), no. 5, Sep. - Oct. 1983 p 94-98 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

Motion of a wedge at supersonic velocity toward a boundary separting two gaseous media is analyzed, considering a compression shock wave but not a rarefaction wave reflected by that boundary as the wedge approaches. The shock wave is assumed to return to the wedge normally to its face. The state of the gas in both regions is described with boundary conditions at their interface including the velocity discontinuity, in a system of coordinates fixed at the triple point and moving at constant velocity with the wedge. The velocities in the two gaseous regions cannot be equal, the pressures and the velocities on both sides of the contact discontinuity surface at the wedge must be respectively equal, and the streams at that surface must be parallel upon their deflections behind the forward wave and the reflected wave respectively. The problem is formulated mathematically with the aid of 12 available relations at the three pressure jumps in the system. On this basis is then calculated the compression ratio as function of the Mach number of the oncoming stream, for a fixed adiabatic exponent and various wedge angles, and as function of the adabatic exponent over the k = 0-2.0 range at a fixed Mach number (M = 2.4). R.J.F.

N84-22791# Joint Publications Research Service, Arlington, Va.
THEORY OF HYPERSONIC THREE-DIMENSIONAL FLOW OF NONSTEADY GAS STREAM WITH RELAXATION PAST THIN WING WITH ARBITRARY ASPECT RATIO Abstract Only c02
M. M. Kuznetsov *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 14 Transl. into ENGLISH from Zh. Prikl. Mekhan. Tekhn. Fiz. (Novosibirsk, USSR), no. 5, Sep. - Oct. 1983 p 88-93 Previously announced in IAA as A84-21120 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

The three-dimensional uniform hypersonic flow over the windward side of a slender wing with a time-dependent surface configuration and at a constant angle of attack is examined. It is considered tha the flow in the shock layer is accompanied by physico-chemical changes and is of a relaxing character. The thickness of the shock lyer is taken to be proportional to the small parameter epsilon, which is equal to the characteristic value of the density ratio at the head shock ave front. The thin shock layer method is applied to a wing of arbitrary aspct ratio to obtain exact particular solutions for the direct and inverse problems of unsteady nonuniform gas flow around a wing. The direct problem is formulated for a numerical-integration solution. R.J.F.

N84-22792# Joint Publications Research Service, Arlington, Va.
EXCITATION OF TOLLMIN-SCHLICHTING WAVES IN BOUNDARY LAYER AT VIBRATING SURFACE OF INFINITE-SPAN SWEPTBACK WING Abstract Only c02
A. M. Tumin *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 15 Transl. into ENGLISH from Zh. Prikl. Mekhan. i Tekhn. Fiz. (Novosibirsk, USSR), no. 5, Sep. - Oct. 1983 p 70-74 Previously announced in IAA as A84-21117 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

The excitation of instability waves in a three-dimensional boundary layer of a compressible gas on the vibrating surface of a swept wing of infinite span is analyzed. The linearized Navier-Stokes equations, accounting for the equation of state after a time Fourier transform, are given. The solution of these equations for the case of a weakly nonuniform flow in the x-direction is presented in the form of a biorthogonal system of vectors. Attention is given to the resonance case, when the frequency and wave number characterizing the vibrating surface coincide with corresponding parameters for unstable excitation at the point of stability loss. A symmetric NACA 0012 foil section at zero angle of attack and a sweep angle of 30 degrees in analyzed. R.J.F.

N84-22793# Joint Publications Research Service, Arlington, Va.
CALCULATION OF APPARENT MASSES IN BLADE RING Abstract Only c07
L. A. Tkacheva *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 15-16 Trans. into ENGLISH from Zh. Prikl. Mekhan. i Tekhn. Fiz. (Novosibirsk, USSR), no. 5, Sep. - Oct. 1983 p 56-62 Previously announced in IAA as A84-21115 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

For the case of irrotational fluid flow along a three-dimensional annular cascade of thin blades, the plane theory of lattices is used to calculate the coefficient of apparent additional masses. The blades undergo small harmonic oscillations with constant phase shift in an incompressible fluid. The average law of oscillations is used in the case of small blade aspect ratio, and the hypothesis of cylindrical sections is used in the case of large blade aspect ratio. Author

N84-22794# Joint Publications Research Service, Arlington, Va.
INTERACTION OF UNSTEADY SPATIAL BOUNDARY LAYER WITH HYPERSONIC FLOW NEAR RAPIDLY HEATED PORTION OF SURFACE Abstract Only c02
A. V. Kazakov *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 16 Transl. into ENGLISH from Izv. Akad. Nauk SSSR: Mekhan. Zhidkosti i Gaza (Moscow), no. 5, May 1983 p 65-72 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

Unsteady three-dimensional flow is produced by heating a small portion of the surface of a flat plate in a hypersonic flow. The distance from the leading edge of the plate to the portion of the surface whose temperature is increased by an amount on the order of the initial surface temperature by means of any internal or external energy source is approximately the same as the distance from the side edges of the plate. The interaction of the laminar boundary layer with the external hypersonic flow is slight. The gas is ideal with a constant specific heat. An analysis of the resulting Navier-Stokes equations shows that with steady planar

and three-dimensional flows, three characteristic regions can be distinguished near the heated section. Region 1 is the perturbed portion of the nonviscous hypersonic flow; in region 2, whose thickness is on the order of the unperturbed boundary layer in front of the interaction region, the flow is nonviscous with vortical turbulence. Region 3 is a viscous layer near the wall in which the perturbations of the velocity and enthalpy are on the order of these quantities at the surface of the obstacle itself in the unperturbed boundary layer. Author

N84-22795# Joint Publications Research Service, Arlington, Va.
HYPERSONIC FLOW AROUND FLAT BODY IN CASE OF INTENSE RADIATIVE HEAT EXCHANGE Abstract Only c02
I. V. Nemchinov and S. P. Popov *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 17 Transl. into ENGLISH from Izv. Akad. Nauk SSSR: Mekhan. Zhidkosti i Gaza (Moscow), no. 5, May 1983 p 126-129 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

Radiant heat flow modes using numerical estimates are applied to flat bodies entering a planetary atmosphere. The steady state two dimensional problem of a hypersonic flow of a nonviscous radiating gas around a flat thermally insulated body is solved numerically taking into account the radiative energy transport. The occurrence of a heated region around the body with dimensions that are an order of magnitude greater than the size of the solid itself is noted. The temperature here proves to be practically equalized while the gas velocity is close to that of the incident flow (the heated gas flow has a Mach number of from 3 to 6). A narrow region of strongly compressed gas is produced immediately ahead of the solid. At the higher incident gas velocities, the flow far from the body can be approximated by replacing it with a heat source having a specific power described by a simple analytical expression. The proposed procedure makes it possible to determine the detailed flow pattern around such bodies in these radiation modes, where radiative heat conductivity is dominant; the pattern proves to be quite different from the usual gas dynamic modes. M.A.C.

N84-22796# Joint Publications Research Service, Arlington, Va.
TRANSONIC FLOW AROUND PROTRUDING CORNER WITH FREE STREAMLINE Abstract Only c02
V. N. Diyesperov *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 17-18 Transl. into ENGLISH from Izv. Akad. Nauk SSSR: Mekhan. Zhidkosti Gaza (Moscow), no. 5, May 1983 p 130-137 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

An ideal gas flow parallel to a plane encounters a turning point where the plane breaks back acutely away from the flow. The transonic gas flow around this corner is described by an asymptotic analysis of a system of Navier-Stokes equations when the Reynolds number approaches infinity in the viscinity of the corner point. The ultimate flow is the free streamline from the vertex of this corner angle, at which the speed of sound is achieved. The equations describing the boundary layer flow near this trailing edge are written and solved assuming that the coefficient of viscosity is a linear function of temperature and that the surface of the angle is thermally insulated. M.A.C.

N84-22797# Joint Publications Research Service, Arlington, Va.
WAVE DRAG OF ELONGATED ASTROID BODIES AT MODERATE SUPERSONIC FLIGHT VELOCITIES Abstract Only c02
M. I. Folle *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 18 Transl. into ENGLISH from Izv. Akad. Nauk SSSR: Mekhan. Zhidkosti i Gaza (Moscow), no. 5, May 1983 p 146-151 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

The wave drag can be described by a formula which reduces the three dimensional problem to a plane boundary value problem. The given formula is written as a function of parameters which include the number of sides of the star, 2n; the Mach number, M, and B(2) = (M(2)-1)(1/2), the half-angle at the vertex of one of the extremities formed by a line running from the center of the body to this vertex. For any combinations of the parameters RB (R is the maximum thickness of the body), n, the vertex half-angle and yet a fourth parameter which describes the longitudinal contour of the body, the astroid configuration is superior in terms of drag to the equivalent axially symmetric form (equivalent with respect to the midsection area and aspect ratio). This is illustrated graphically for six slender shapes; a circle, pentagon, square, triangle and two five-pointed stars. M.A.C.

N84-22798# Joint Publications Research Service, Arlington, Va.
STUDY OF LARGE VISCOPLASTIC STRAINS IN CYLINDRICAL SHELLS BY METHOD OF MAGNETIC-PULSE LOADING Abstract Only c39
V. G. Bazhenov, V. K. Lomunov, M. V. Petrov, and A. G. Ugodchikov *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 19-20 Transl. into ENGLISH from Mashinovedeniya (Moscow), no. 5, Sep. - Oct. 1983 p 73-80 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

Dynamic stress-strain curves for viscoplastic materials are constructed on the basis of experimental data obtained by magnetic-pulse loading of rings and cylindrical shells. Tests were performed with a magnetic loading machine, its capacitor bank of 1600 microfarad with a natural frequency of 12.6 kHz capable of delivering 20 kilojoules of energy per pulse. Measurements were made with an inductive pressure transducer and an optoelectronic displacement transducer. The procedure for processing the experimental data, involves plotting the deflection w(t) and the pressure p(t) as functions of time, then calculating the velocity and the accleration as well as the second invariants I(2 sigma), I(2 epsilon), of the stress tensor and the strain tensor with constant second invariant I(2 epsilon) of the strain rate tensor for plotting I(2 sigma) = f(I(2 epsilon), I(2(epsilon)) curves. The ean stress-strain curves are then obtained by the method of least squares. This procedure was applied to specimens of aluminum alloys. The experimental results were evaluated on the basis of the geometrically nonlinear Timoshenko theory for double layer structures, assuming a small shear strain and an ideal initial shape. Three modes of deformation were analyzed in this way. M.A.C.

N84-22799# Joint Publications Research Service, Arlington, Va.
ESTIMATION OF LOCAL STRESS INTENSITY IN FLANGED THIN-WALL SHELL STRUCTURES UNDER HEAVY THERMAL LOAD Abstract Only c39
V. N. Khoroshilov, P. I. Kotov, and A. P. Gusenkov *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 20 Transl. into ENGLISH from Mashinovedeniye (Moscow), no. 5, Sep. - Oct. 1983 p 64-72 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

Components of a gas turbine are examined for stress intensity as examples of typical flanged shell structures under heavy thermal load. The stress intensity in such elements, especially at the shell flange transition, is estimated on the asis of temperature distributions in four stages of a load cycle; (1) initial cold state (170 C) with small longitudinal temperature gradient, (2) fast heating (to 470 C) during load application (5-10 c per sec), (3) maximum temperature (600-700 C) in steady state (24 min) following temperature equalization with attendant decrease of the longitudinal temperature gradient, (4) temperature drop below initial level during fast load dumping with attendant buildup of longitudinal temperature gradient in opposite direction. Calculations are made and stress diagrams are plotted for two types of cylindrical shells and a spherical shell. Stress analysis is based on solution of the thermoelasticity problem for axial and meridional forces and for bending moments in an axisymmetric temperature field. The corresponding system of eighth-order partial differential equations was solved by numerical methods according to an algorithm programmed on a computer. M.A.C.

N84-22800# Joint Publications Research Service, Arlington, Va.
STRESSED-STRAINED STATE OF FLANGED SHELLS UNDER HEAVY THERMAL LOAD BEYOND ELASTIC LIMIT Abstract Only **c39**
A. P. Gusenkov, P. I. Kotov, V. N. Khorotilov, and S. F. Kuznetsov *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 21 Transl. into ENGLISH from Mashinovedeniye (Moscow), no. 6, Nov. - Dec. 1983 p 56-66 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

Stresses and strains in thin walled shells with flanges in a gas turbine are analyzed beyond the elastic limit of the material. Two kinds of such shells are considered representing a contrast in elastoplastic deformation characteristics, subject to temperature cycling in the danger zone over the ranges from 170 to 610 C and from 220 to 670 C respectively. The analysis is based on solution of the problem of thermal stresses for thin walled shells according to the theory of variable stiffness shells and of the problem of nonisothermal deformation. Isochronous stress strain curves are calculated and plotted, with residual stresses taken into account. The analysis is further refined by appropriately applying the theory of plasticity and considering rheological effects, specifically creep. Calculations programmed on a computer by the finite element method were made for heat-resistant alloy steel.
M.A.C.

N84-22801# Joint Publications Research Service, Arlington, Va.
PLANE MOTION OF SOLID BODY ON ROUGH SURFACE OF ANNULAR BEARING ROTATING ABOUT ITS AXIS PERPENDICULAR TO PLANE OF MOTION Abstract Only **c37**
G. Ya. Panosko *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 21-22 Transl. into ENGLISH from Mashinovedeniye (Moscow), no. 1, Jan. - FEb. 1984 p 13-15 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

Rectilinear horizontal motion of a solid body in an annular bearing with a rough surface rotatin about its vertical axis is analyzed. The motion is characterized by an apparent conversion of dry friction to viscous frition. The dry friction force is assumed to depend nonlinearity on the sliding velocity. Calculation of the total friction force, which involves evaluation of a double (surface) integral, reveals that at an optimum angular velocity the friction is minimum. As the angular velocity increases, the efficiency of friction conversion decreases. The results can be useful in practical attempts to reduce dry friction and thus prevent self-excited vibrations.
M.A.C.

N84-22802# Joint Publications Research Service, Arlington, Va.
SYSTEM FOR TORQUE CONTROL OF UNBALANCED ROTOR DURING PASSAGE THROUGH RESONANCE Abstract Only **c37**
A. S. Kelzon and L. M. Malinin *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 22 Transl. into ENGLISH from Mashinovedeniye (Moscow), no. 1, Jan. - Feb. 1984 p 16-23 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

Starting and acceleration of an unbalanced rotor in a machine with one rotational and several vibrational degrees of freedom is described by a system of nonlinear differential equations, which serve as basis for devising a torque control for such a rotor during its passage through resonance. For the purpose of analysis, the equations of motion are converted from matrix and vector form to normal coordinates, or binormal ones in the case of a nonself-adjoint system with at least one asymmetric matrix of coefficients, through diagonalization with critical speed as the argument. An approximately optimum law of torque control is proposed on the basis of slow asymptotic variables in the mass/speed plane. This law is synthesized so as to include the influence of six parameters (damping coefficient, unbalance factor squared, torque before and after control action, nominal speed, instantaneous speed during transition) and the indeterminacy of some parameters (damping coefficient, unbalance factor in the sense that they are either unknown or stipulated with an error.
M.A.C.

N84-22803# Joint Publications Research Service, Arlington, Va.
AUTOMATIC ELIMINATION OF STATIC UNBALANCE OF ROTOR IN ANISOTROPIC BEARINGS Abstract Only **c71**
V. P. Nesterenko *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 23 Transl. into ENGLISH from Mashinovedeniye (Moscow), no. 1, Jan. - Feb. 1984 p 24-25 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

A transversally isotropic spherical shell immersed in an ideal fluid is analyzed. An acoustic wave of finite length impinges on the shell. The scattered pressure field is determined using a generally adopted linear formulation where the motion of the shell is described by Timoshenko type equations, assuming that the Young's modulus in the middle surface is independent of the transverse shear modulus. The proposed construction of the near front asymptotic behavior of the echo from the shell can be used in the case of shells with a noncanonical configuration. The resulting analytical equations are used to plot the pressure scattered by a steel shell in water exposed to a short-lived incident wave as a function of time.
M.A.C.

N84-22804# Joint Publications Research Service, Arlington, Va.
APPROACH TO SOLVING PROBLEM OF ACOUSTIC WAVE DIFFRACTION BY ELASTIC SHELL Abstract Only **c27**
O. V. Vlzhiyevskaya *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 23 Transl. into ENGLISH from Dokl. Akad. Nauk Ukr. SSR Ser. A: Fiz.-Mat. i Tekhn. Nauki (Kiev), no. 11, Nov. 1983 p 31-35 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

The method of proving that balls retained in an annular groove of a rotor to form an anisotropic bearing will automatically eliminate the static unbalance at rotor speeds higher than the natural frequency is applied to a vertical rotor. The conditions for stability and asymptotic stability of steady rotation are established on the basis of analysis and calculations for any ideally stiff rotor in a bearing with only two balls. Transition from stable to unstable rotation occurs not only at a critical speed but also at the speed which corresponds to equal amplitudes of rotor vibrations along two orthogonal horizontal coordinates.
M.A.C.

N84-22805# Joint Publications Research Service, Arlington, Va.
SOLVING STATICS PROBLEMS OF THICK-WALLED CYLINDRICAL SHELLS WITH LOOSE CONTACT BETWEEN LAYERS Abstract Only **c39**
A. T. Vasilenko, Ya. M. Grigorenko, and N. D. Pankratova *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 24 Transl. into ENGLISH from Dokl. Akad. Nauk Ukr. SSR Ser. A: Fiz.-Mat. i Tekhn. Nauki (Kiev), no. 11, Nov. 1983 p 40-43 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

Thick walled, layered shell structures are subjected to axial stresses at the end faces, which are distributed so that the ends remain flat. The shells are made of orthotropic materials and the friction at the contact surface between the layers is disregarded, with the assumption of ideal slippage over the contact area. Analytical expressions describing the deformed stressed state of such shells in a spatial formulation are derived. The solution is illustrated with the example of axially symmetric deformation of a two layer shell of isotropic materials. Graphs are plotted for this case showing both the tangential and axial stress distributions in the shell. With slippage between the layers in a homogeneous shell, in the case where the shell diameter is equal to its length, the tangential stresses are 25% of their value when the layers are tightly joined together; there is also a reduction in the axial stresses.
M.A.C.

N84-22806# Joint Publications Research Service, Arlington, Va.
APPARATUS FOR CERTIFICATION OF ANGULAR-DISPLACEMENT TRANSDUCERS Abstract Only **c35**
B. N. Ivanov *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 25 Transl. into ENGLISH from Izmeritelnaya Tekhn. (Moscow), no. 10, Oct. 1983 p 20-22 (For

primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

An apparatus for determining the accuracy of inductive, photoelectric, and other angle-to-code converters with angular displacement transducers is examined. The operation of the various test stands for this purpose is based on measuring the electric output pulse signals from the sample transducers and a reference transducer and recording them in the form of phase difference diagrams, while the shafts of both transducers rotate synchronously, then determining the error of the sample transducer from those diagrams superposed on one another so as to correspond to the same angular position of both shafts. The mechanical components of such a test stand include an electric drive motor with speed regulation, a belt transmission, a worm gear for speed reduction, a flexible coupling, a bellows, a stator fixture, a centering mechanism, an index dial, a digital counter, and a tape winder. Prototypes of such a test stand were checked against a special phase meter with a kinematometer. These tests stands were found to be adequate for certification of transducers in the 1-2 precision class. M.A.C.

N84-22807# Joint Publications Research Service, Arlington, Va.
MEASURING ROUGHNESS OF ULTRASMOOTH SURFACES BY REFLECTOMETRIC METHOD Abstract Only **c74**
F. M. Solodukho *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 26-27 Transl. into ENGLISH from Izmeritelnaya Tekhn. (Moscow), no. 10, Oct. 1983 p 17-20 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

The feasibility of measuring the roughness of ultrasmooth surfaces by the reflectometric method is examined on the basis of two theories, the classical scalar theory of scattering and the vector theory of reflection for electromagnetic waves. The scalar theory treats the surface statistically only. The vector theory also accounts for the physical nature of electromagnetic radiation, including the polarization state of incident and reflected waves, as well as the optical properties of the surface material and the interaction of electromagnetic waves with free electrons at the boundary between two media. The mathematical relations for reflectometry are derived from the solution to the diffraction problem in the Kirchhoff approximation, with appropriate boundary conditions in a hemispherical space. Using the scalar theory requires a statistical analysis of ultrasmooth surfaces and a need to determine the roughness distribution function as well as correlation function. One optical instrument used for this purpose is a multibeam interferometer. Another instrument used for this purpose is an optical feeler gauge with digital readout. Measurements made on specimens of many materials (quartz, silicon carbide, copper, nickel, titanium, molybdenum, aluminum, Invar, Monel metal, rock salt, stainless steel) with superfine surface finish indicate a normal distribution but nonGaussian correlation of asperity height. All ways to determine the standard deviation of asperity heights and the correlation interval as well as the spectral density function and the correlation function are still burdened with appreciable error. M.A.C.

N84-22808# Joint Publications Research Service, Arlington, Va.
BALANCING OF FLEXIBLE ROTORS WITH SIMULTANEOUS PRECISE DETERMINATION OF INFLUENCING FACTORS Abstract Only **c37**
B. V. Ryzhik and V. M. Pridman *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 27-28 Transl. into ENGLISH from Mashinovedeniye (Moscow), no. 1, Jan. - Feb. 1985 p 26-32 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

An algorithm of balancing is proposed for a flexible horizontal rotor in isotropic bearings at several speeds, nominal operating speed as well as near critical ones. It is based on the equations of flexural vibrations of a rotating shaft, assuming that the latter has a variable circular cross section and rests in two linear isotropic elastoviscous bearings. There are two groups of balancing methods possible. Either all these equations are satisfied simultaneously so that rotor vibrations at all selected frequencies cease, or this system of equations is solved iteratively so that balancing proceeds successively at each selected frequency alone. Simultaneous balancing is preferable to sequential balancing, because it requires fewer startups. The proposed algorithm of such balancing utilizes a priori information about influencing factors, which significantly reduces the intensity of vibrations during the balancing process. M.A.C.

N84-22809# Naval Surface Weapons Center, White Oak, Md.
GRIT BLASTING A DISTRIBUTED ROUGHNESS BASED ON A 30% PROBABILITY OF EXCEEDENCE Final Report, Jan. - Mar. 1981
E. J. Becker and M. D. Jobe Oct. 1983 29 p
(AD-A138779; NSWC/MP-83-444) Avail: NTIS HC A03/MF A01 CSCL 13/8

The objective of this study was to obtain a prescribed roughness on a metal surface through control of grit blasting techniques. It includes a description of the equipment used to grit blast the metal samples, the grit-blasting technique, the photomicrographic technique, and the procedure used to characterize the roughness. As a result, calibration curves were obtained which gave surface roughness as a function of grit blasting pressure setting, grit size, and surface material. Author (GRA)

N84-22810# Army Construction Engineering Research Lab., Champaign, Ill.
FIXITY OF MEMBERS EMBEDDED IN CONCRETE Final Report
F. Castilla, P. Martin, and J. Link Feb. 1984 66 p
(DA Proj. 4A1-62720-A-896)
(AD-A138862; CERL-TR-M-339) Avail: NTIS HC A04/MF A01 CSCL 13/13

For concrete structures founded on piles, the length of pile embedment required to develop a condition to full fixity has a significant impact on the cost of the structure. The purpose of this research was to determine the pile embedment length required to provide reasonable assurance that a condition of full fixity exists for a pile embedded in the base of a concrete structure. A two-part study was performed on models of a cap-member-soil system and a cap-member system to evaluate the degree of rotational fixity associated with various pile embedment lengths and various pile types, including typical design conditions for HP 14X73 and HP 14X117 piles. The study results indicate that a pile embedment length equal to or greater than twice the pile depth or diameter is required to develop a condition approximating full fixity for a pile embedded in the base of a concrete structure. GRA

N84-22811# Sheffield Univ. (England). Dept. of Control Engineering.
DIRECT DIGITAL CONTROL OF THE ELECTRIC ARC FURNACE
A. S. Morris Jul. 1983 24 p refs
(RR-233) Avail: NTIS HC A02/MF A01

Control requirements for electric arc furnace electrode position control, voltage tap changing, least cost mix calculation and maximum demand control are discussed. Schemes for electrode position control are presented, and their performance is compared by digital simulation. Requirements for direct digital control are considered and a scheme for hardware and software implementation of furnace control algorithms is suggested. Author (ESA)

N84-22812# Sheffield Univ. (England). Dept. of Control Engineering.
ROBUSTNESS AND SENSITIVITY OF SMITH PREDICTOR CONTROLLERS FOR TIME-DELAY SYSTEMS
H. M. Wang and A. Chotai Aug. 1983 27 p refs
(RR-238) Avail: NTIS HC A03/MF A01

The robustness theorem for the extended Smith scheme is derived. Parameter optimality problems are discussed. Results indicate that the performance is improved by temporal mismatch or properly chosen feedback component. Minimization of the performance index can be one of the criterions for choosing the temporal model. When the feedback in either inner or outer loop

is not unity, the steady state error should be carefully checked even though an integral action is included in the controller. The sensitivity functions for Smith scheme in the multivariable case are established. In spite of their complex structure they can be checked numerically. Author (ESA)

N84-22813# Rolls-Royce Ltd., Derby (England).
MULTI-SMALL HOLE DRILLING BY EDM
D. F. Tolier Apr. 1983 11 p
(PNR-90184; Reprint-897) Avail: NTIS HC A02/MF A01

Electrodischarge machining processes were developed so that large numbers of small cooling holes can be drilled at economic production rates in gas turbine components. Developments in electrode contact and refeed systems, multidirectional electrode guides and machine tools are described. Trends in small hole drilling technology are indicated. Author (ESA)

N84-22814# Rolls-Royce Ltd., Derby (England).
MANUFACTURING INFLUENCE OF DESIGN AND ITS IMPORTANCE TO SUCCESSFUL AUTOMATION
F. Turner 1983 9 p
(PNR-90189; Reprint-902) Avail: NTIS HC A02/MF A01

Cooperation between designers and manufacturers of aircraft engines and engine parts is discussed. The contributions of computer aided design and manufacture, and standardization of cutting tools are summarized. Automated inspection is described. Author (ESA)

N84-22815# Rolls-Royce Ltd., Derby (England).
A REVIEW OF ADVANCED MANUFACTURING TECHNOLOGY
T. Broughton Mar. 1981 16 p Presented at Brit. Aviation Seminar and Exhibition 1981, Delhi, 17-19 Mar. 1981 and Bangalore, 25-27 Mar. 1981
(PNR-90194; Reprint-758) Avail: NTIS HC A02/MF A01

Joining techniques, hot forming technology, forging technology, investment casting, small cooling hole manufacturing, combustor technology, quality assurance, and chip forming machining of gas turbine engine components are discussed. Electron and laser beam welding; laser hard facing techniques; automatic TIG and plasma welding; diffusion brazing of titanium and nickel alloys; heated die forming: blow forming; superplastic forming; fan and compressor blade forging; and wheel and disk forging from powder superalloys are described. Author (ESA)

N84-22816# Sheffield Univ. (England). Dept. of Control Engineering.
ANALYSIS OF THE TRANSFER FUNCTION MODEL OF TRAY-TYPE BINARY DISTILLATION COLUMNS WITH LIQUID HYDRAULIC DELAY
J. B. Edwards and B. M. Zhou Jul. 1983 23 p refs
(RR-234) Avail: NTIS HC A02/MF A01

A transfer function model (TFM) in the frequency domain is used to predict that a distillation column system (compositions to terminal flow rate) is a low pass filter with large time constants and low cut-off frequency. Computed results in frequency and time domains reveal the strong resemblance of the dynamic behavior of this system to that of first order lag, both qualitatively and quantitatively. At low frequency the elements of the TFM can be expanded by Taylor theorem into an approximate analytical model of a first-order-lag type. Solving difference equations directly can give more exact results, so that the better way to describe a tray-type distillation column in frequency domain is to use difference equations. There is no need to use differential equations to approximate the difference equation. Author (ESA)

N84-22817# Sheffield Univ. (England). Dept. of Control Engineering.
THE EFFECTS OF WIDENING TIME CONSTANTS AND INCREASING TIME DELAY ON CONTROLLER DESIGN USING APPROXIMATE MODELS
H. M. Wang and A. Chotai Oct. 1983 26 p refs
(RR-239) Avail: NTIS HC A03/MF A01

It is shown that when time constants are widespread or the time delays are large, a proportional controller which is designed using pseudodiagonal or first order model often fails to get an acceptable performance. Design techniques used in the p+I control case can cover a notable widening of time constants or relatively large time delay in individual elements. In cases where the time delays in a whole line are relatively large, the design technique is difficult to use to get an acceptable performance. Author (ESA)

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

N84-22818# British Broadcasting Corp., London (England). Engineering Div.
THE CARFAX ROAD TRAFFIC INFORMATION SYSTEM
R. S. Sandell Feb. 1984 41 p refs Original contains color illustrations
(BBC-RD-1984/1) Avail: Issuing activity

A description of the development work and field trials which led to the completion of the dedicated traffic information service 'CARFAX' is presented. The system employs a single medium frequency channel, and involves a network of low powered transmitters that operate in time division multiplex to provide traffic announcements. A description of the network distribution, equipment test, results and future system utilization is included. M.A.C.

N84-22819# British Broadcasting Corp., London (England). Engineering Div.
INTERMODULATION BETWEEN V.H.F./F.M. BROADCAST TRANSMITTERS AND THE PROTECTION OF ADJACENT-BAND AERONAUTICAL SERVICES
G. H. Millard Mar. 1984 14 p refs
(BBC-RD-1984/2) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

The VHF/FM broadcast band was extended to 108 MHz to put broadcasting and aeronautical radionavigation. The technical constraints to be used in planning the new band, which specifically called for consideration to be given to the avoidance of interference to the aeronautical services were determined. The mechanisms by which interference are described and conditions which it is thought will avoid interference are given. Author

N84-22820* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
DOPPLER RADAR HAVING PHASE MODULATION OF BOTH TRANSMITTED AND REFLECTED RETURN SIGNALS Patent
Herbert S. Kobayashi, Paul W. Shores, and Patrick Rozas, inventors (to NASA) Issued 27 Mar. 1984 8 p Filed 22 May 1981
(NASA-Case-MSC-18675-1; US-Patent-4,439,766; US-Patent-Appl-SN-266687; US-Patent-Class-343-9R; US-Patent-Class-343-17.5) Avail: US Patent and Trademark Office CSCL 17I

A microwave radar signal is generated for transmission through an antenna. Before transmission, the signal is phase modulated by 0 deg or 90 deg amounts during each alternate half-cycles of an intermediate frequency (IF) clock signal. After transmission and return, the signal is again phase modulated the same amounts during each alternate half-cycles. The return phase modulated signal is mixed with a leakage signal component of the microwave signal, leaving an IF Doppler. The IF Doppler signal may then be amplified, removing any requirement that direct current level signals be amplified and also removing the effect of detector noise from the Doppler signal.

Official Gazette of the U.S. Patent and Trademark Office

N84-22821# University of Southern California, Los Angeles. Communications Sciences Inst.

RESEARCH TRENDS IN MILITARY COMMUNICATIONS Final Report, 18 Nov. 1982 - 17 Oct. 1983
Robert A. Scholtz, ed., Charles L. Weber, ed., John Silvester, ed., Mary Ann Kiefer, ed., and Peter Pawlowski, ed. 17 Dec. 1983 340 p refs Workshop held in Wickenburg, Ariz., 1-4 May 1983 (Contract DAAG29-83-M-0065)
(AD-A138229; CSI-83-12-01; Rept-53-4503-9802; ARO-20168.1-EL) Avail: NTIS HC A015/MF A01 CSCL 17/2

A review of basic research in spread spectrum communicatons, the evaluation of present needs, and the determination of fruitful future research areas are included. Array signal processing in the spread spectrum environment, spead spectrum communication in jamming, applications of coding to spread spectrum communication, and spread spectrum networks are discussed. For individual titles, see N84-22822 through N84-22834.

N84-22822# Adaptive Sensors, Inc., Santa Monica, Calif.
[SIDELOBE CANCELLING TECHNIQUES USED IN WIDEBAND SYSTEMS]
John Bailey *In* Univ. of Southern California Res. Trends in Mil. Commun. 17 Dec. 1983 p 14-30 (For primary document see N84-22821 13-32)
Avail: NTIS HC A15/MF A01 CSCL 17/2

An overview of SIDELOBE cancelling techniques is given. Emphasis is placed on the technique of sub-banding, a technique in which you have a very wide bandwidth and you break that bandwidth into a bunch of sub-bands and then you independently adapt in each one of those sub-bands which are now narrowband and then you combine the result of the output and generate the adapted wide bandwidth output. Degrees of freedom techniques and time delays are discussed. Receiver equalization problems encountered with mismatched receivers are discussed. R.J.F.

N84-22823# TRW Defense and Space Systems Group, Redondo Beach, Calif.
[MULTIPLE ACCESS ADAPTIVE ANTENNAS]
James Dupree *In* Univ. of Southern California Res. Trends in Mil. Commun. 17 Dec. 1983 p 31-74 refs (For primary document see N84-22821 13-32)
Avail: NTIS HC A15/MF A01 CSCL 17/2

Multiple access adaptive antennas are discussed, primarily as they are applied to the Tracking and Data Relay Satellite System. Multiple access provided by on area coverage beam is discussed. R.J.F.

N84-22824# TRW Defense and Space Systems Group, Redondo Beach, Calif.
ENHANCEMENT OF SPREAD-SPECTRUM SYSTEMS THROUGH ADAPTIVE ANTENNA TECHNIQUES
James E. Dupree *In* Univ. of Southern California Res. Trends in Mil. Commun. 17 Dec. 1983 p 75-82 refs (For primary document see N84-22821 13-32)
Avail: NTIS HC A15/MF A01 CSCL 17/2

The relative signal to noise ratio (S/N) advantage of optimal adaptive spatial filtering, which forms nulls, over simpler antennas which form beams in the user directions and depend upon low sidelobes for interference rejections is discussed. This relative advantage is expressed as an enhancement ratio that depends upon the interference signal parameters and upon the beam correlation, which relates the geometric and array-structure parameters. These results show when it is useful to add adaptive nulling to the spread-spectrum system, given an array structure and interference environment. Also, the multiple access use of optimum adaptive arrays is discussed and bounds on achievable S/N pairs and an optimum allocation procedure are presented. R.J.F.

N84-22825# Michigan Univ., Ann Arbor.
[ADAPTIVE ARRAY COMBINED WITH SPREAD SPECTRUM IN COMMUNICATIONS]
Martin Ristenbatt *In* Univ. of Southern California Res. Trends in Mil. Commun. 17 Dec. 1983 p 83-90 (For primary document see N84-22821 13-32)
Avail: NTIS HC A15/MF A01 CSCL 17/2

The combining of the adaptive array with spread spectrum communications is discussed. Electronic countermeasures are surveyed. R.J.F.

N84-22826# Naval Weapons Center, China Lake, Calif.
[REACTIVELY STEERED ADAPTIVE ARRAY (RESAA)]
Robert Dinger *In* Univ. of Southern California Res. Trends in Mil. Commun. 17 Dec. 1983 p 91-104 refs (For primary document see N84-22821 13-32)
Avail: NTIS HC A15/MF A01 CSCL 17/2

Reactively steered adaptive arrays are discussed. A concept is discussed in which there is one element in the array that is only connected to the receiver the other elements are all parasitic. They are mounted in close proximity to get tight coupling, and the beam pattern is formed by the valves of the adjustable reactive terminations. The output of the receiver is monitored and an adaptive algorithm is used to adjust the reactive terminations. The center element is receiving scattered radiation from the parasitic elements. The scattered radiation phase depends critically on the value of the reactive terminations. R.J.F.

N84-22827# California Inst. of Tech., Pasadena. Dept. of Electrical Engineering.
SPREAD SPECTRUM COMMUNICATION IN JAMMING
Bob McEliece *In* Univ. of Southern California Res. Trends in Mil. Commun. 17 Dec. 1983 p 116-123 (For primary document see N84-22821 13-32)
Avail: NTIS HC A15/MF A01 CSCL 17/2

Spread spectrum communications in jamming are discussed. The game minimax design, or how the communicator beats the jammer, is discussed from an analytical point of view. An example of a jamming game is given involving a transmitter and a jammer. A noise signal and a signal are somehow combined. The transmitter wants the received signal to look like what he transmitted while the jammer has the opposite intension. The signal and noise stochastic processes are modeled. Strategies are discussed. R.J.F.

N84-22828# Defense Advanced Research Projects Agency, Arlington, Va. Tactical Technology Office.
[JAM-RESISTANT TACTICAL COMMUNICATIONS]
Jerry Gobien *In* Univ. of Southern California Res. Trends in Mil. Commun. 17 Dec. 1983 p 143-151 (For primary document see N84-22821 13-32)
Avail: NTIS HC A15/MF A01 CSCL 17/2

This paper addresses the problem of jam-resistant communications. The Air Force's Tactical Jam resistant voice communication system-SEEK-TALK is described in detail. This communications system was originally to be an improvement or replacement for the UHF am radio. Networking requirements and cost estimates are discussed. B.W.

N84-22829# Cyclotomics, Inc., Berkeley, Calif.
APPLICATIONS OF CODING TO SPREAD SPECTRUM COMMUNICATIONS
Elwyn Berlekamp *In* Univ. of Southern California Res. Trends in Mil. Commun. 17 Dec. 1983 p 169-183 refs (For primary document see N84-22821 13-32)
Avail: NTIS HC A15/MF A01 CSCL 17/2

This paper discusses the applications of coding to spread spectrum communications error-correcting codes and interleaving schemes are described. B.W.

N84-22830# M/A-COM LINKABIT, Inc., San Diego, Calif.
[TRENDS IN CONVOLUTIONAL CODING]
Joe Odenwalder *In* Univ. of Southern California Res. Trends in Mil. Commun. 17 Dec. 1983 p 184-198 (For primary document see N84-22821 13-32)
Avail: NTIS HC A15/MF A01 CSCL 17/2

Needs and trends in convolutional coding are discussed. Performance considerations are discussed in relationship to

jamming environments, atmospheric simulation and nuclear simulation. B.W.

N84-22831# Defense Advanced Research Projects Agency, Arlington, Va.
SPREAD SPECTRUM NETWORKS
Barry Leiner *In* Univ. of Southern California Res. Trends in Mil. Commun. 17 Dec. 1983 p 228-239 (For primary document see N84-22821 13-32)
Avail: NTIS HC A15/MF A01 CSCL 17/2

Two questions are explored in this research. In what way is a spread spectrum network different than the simple addition of spread spectrum and network? What synergistic properties happen that either add or subtract from the capabilities one might expect to get when there is a spread spectrum separately, and a network separately? A packet radio network is described in detail. B.W.

N84-22832# Army Communications-Electronics Command, Fort Monmouth, N.J.
[SPREAD SPECTRUM DATA NETWORKS]
Charles J. Graff *In* Univ. of Southern California Res. Trends in Mil. Commun. 17 Dec. 1983 p 240-254 refs (For primary document see N84-22821 13-32)
Avail: NTIS HC A15/MF A01 CSCL 17/2

Real time spread spectrum data networks are discussed. Data networks in tactical operations are emphasized. Two network models which are based on the ISO (International Standards Organization), are described. The concern here is on the communication subnet, which basically is from the transport layer down which includes the bottom 4 layers. Spread spectrum affects both the network layer and the transport layer. B.W.

N84-22833# Adaptive Sensors, Inc., Santa Monica, Calif.
GENERALIZED ADAPTIVE NODE CONCEPT
John Bailey *In* Univ. of Southern California Res. Trends in Mil. Commun. 17 Dec. 1983 p 296-307 (For primary document see N84-22821 13-32)
Avail: NTIS HC A15/MF A01 CSCL 17/2

A concept is briefly described wherein one can build architectures and develop a single circuit to handle a wide class of adaptive problems including radar, sonar and wideband communication systems. The advantage of the approach is that a wide class of problems can be handled with a cystolic architecture of identical circuits. More specifically a single digital circuit that can be wired together in a feed forward manner, with a pipeline architecture. This is very important because it implies that as the dimensonality of the adaptation increases, the throughput rates remain just as fast as within the pipeline FFT. It's ideal for VHSIC because you can solve many of the world's adaptive problems with a single circuit, limited only by the dynamic range and bandwidth of that circuit. B.W.

N84-22834# University of Southern California, Los Angeles. Communication Sciences Inst.
A DIGITAL ADAPTIVE ARRAY PROCESSING ALGORITHM FOR COMMUNICATIONS
Irving Reed *In its* Res. Trends in Mil. Commun. 17 Dec. 1983 p 308-319 (For primary document see N84-22821 13-32)
Avail: NTIS HC A15/MF A01 CSCL 17/2

An adaptive algorithm scheme was devised using antenna elements that in the presence of jamming and interferene would automatically make synchronization and the selection of signals possible. The important property of this nulling technique is that it does not require a knowledge of signal direction. At the same time the algorithm maximizes the probability of signal selection and/or synchronization. B.W.

N84-22835# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
PROCEEDINGS OF THE 6TH MIT/ONR (MASSACHUSETTS INSTITUTE OF TECHNOLOGY/OFFICE OF NAVAL RESEARCH) WORKSHOP ON C3 (COMMAND, CONTROL, AND COMMUNICATIONS) SYSTEMS Interim Report
M. Athans, E. R. Ducot, A. H. Levis, and R. R. Tenney Dec. 1983 302 p Workshop held at Cambridge, Mass., 25-29 Jul. 1983
(Contract N00014-77-C-0532)
(AD-A138614; LIDS-R-1354) Avail: NTIS HC A14/MF A01 CSCL 05/2

The Sixth MIT/ONR Workshop on Command Control and Communications System (C3) was held from July 25, 1983 through July 29, 1983. Several themes continued to appear throughout this Workshop. The most challenging problem facing C3 scientists is that of devising means to evaluate the performance of alternative C3 system architectures. This must take into account the sensors, communications, and weapons available to friendly as well as enemy forces. It must involve a closed-loop, cybernetic model of the entire military situation and its must inevitably involve a deep understanding of the behavior of the humans which execute the key decision functions from sonar operators through battle group commanders. From the perspective of design, surveillance has been reduced to a relatively precise science, at least compared with the design of the decision function. The purpose of these Workshops is to foster real-time interaction between many of the key contributors in the developing science of C3. For individual titles, see N84-22836 through N84-22864.

N84-22836# Naval Electronic Systems Command, Washington, D. C.
DOING C2 (COMMAND CONTROL) EXPERIMENTS USING WAR GAMES
J. S. Lawson, Jr. *In* MIT Proc. of the 6th MIT/ONR Workshop on C3 (Command, Control, and Commun.) Systems Dec. 1983 p 3-9 (For primary document see N84-22835 13-32)
(AD-P002875) Avail: NTIS HC A14/MF A01 CSCL 15/7

In the last few years considerable progress has been made in the development of an analytic theory of military Command Control (C2), both as a process and as a large-scale system. There are now models of C2 organizations which permit the examination of the effects of various changes in a C2 system and which can predict some of the behavior of such a system in a gross sense. And, due to the increased attention being given the field, with the attendant increase in papers, workshops, etcetera, there is slowly developing a common vocabulary for use in the emerging C2 Theory. What is still lacking, however, is a body of experimental data which can be used as a touchstone to guide further theoretical developments, and against which theoretical predictions can be tested. This paper reports the results of a very rudimentary experiment which was conducted at the Naval Postgraduate School at Monterey, California, during the 1983 Winter Quarter to test two specific hypotheses. As is often the case, it was found necessary to modify or restate the hypotheses during the conduct of the experiment in order to accommodate certain real world constraints. The results, however, are both interesting in their own right and reassuring for the prospect of being able to do further experiments in the C2 arena. Author (GRA)

N84-22837# ALPHATECH, Inc., Burlington, Mass.
A COMPARISON OF TWO AIR DEFENSE COMMAND AND CONTROL MODELS
J. R. Dowdle, R. F. Gendron, L. C. Kramer, and M. P. Merriman *In* MIT Proc. of the 6th MIT/ONR Workshop on C3 (Command, Control, and Commun.) Systems Dec. 1983 p 18-23 (For primary document see N84-22835 13-32)
(Contract F33657-81-C-2150)
(AD-P002876) Avail: NTIS HC A14/MF A01 CSCL 14/2

This paper describes and compares two models of air defense systems which focus on the command and control (C2) aspects of the air defense mission. The models are both computer-based representations of how, through the execution of C2 functions, a defensive force detects and destroys an offensive force of airborne penetrators. However the two models are completely different in the manner in which this engagement is represented. The first model, called QUEB for queuing based, consists of a large set of simultaneous equations derived using queuing theory which solve for the dynamic steady-state conditions

existing throughout the system. The second model, called TADZ for transient air defense zone, is a so-called event-stepped simulation of the air defense engagement. Author (GRA)

N84-22838# Naval Postgraduate School, Monterey, Calif.
LANCHESTER'S EQUATIONS AND GAME THEORY c66
J. M. Wozencraft and P. H. Moose *In* MIT Proc. of the 6th MIT/ONR Workshop on C3 (Command, Control, and Commun.) Systems Dec. 1983 p 24-29 (For primary document see N84-22835 13-32)
(AD-P002877) Avail: NTIS HC A14/MF A01 CSCL 12/1

This article describes how generalization of Lanchester's Equations leads to a model of combat in which different types of Blue forces (say infantry, artillery, armor) suffer attrition due both to aimed and area fire from different types of Orange forces. The attrition coefficients depend on the types of forces and the conditions of combat. Command and Control decisions have great influence on the constraints governing the feasible set of different force compositions which can be brought to bear in a battle. It is hoped that better understanding of how these constraints affect the (optimum) battle outcome will provide insight into the quantitative impact of command and control information systems. Substantial additional work generalizing and interpreting the results to date will be necessary, however, before this becomes possible. GRA

N84-22839# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
INFORMATION PROCESSING AND DECISIONMAKING ORGANIZATIONS: A MATHEMATICAL DESCRIPTION c62
A. H. Levis *In its* Proc. of the 6th MIT/ONR Workshop on C3 (Command, Control, and Commun.) Systems Dec. 1983 p 30-38 (For primary document see N84-22835 13-32)
(Contracts N00014-83-K-0185; MDA903-83-C-0196)
(AD-P002878) Avail: NTIS HC A14/MF A01 CSCL 12/1

An overview of an analytical approach to the modeling and evaluation of information processing and decisionmaking organizations is presented. The mathematical framework used in modeling the individual decisionmakers as well as the organization is that of n-dimensional information theory. The data flow formalism is used to model in a precise manner the various types of interactions between decisionmakers as well as interactions between humans and the command, control, and communication system that supports the organization. Comparison and evaluation of alternative organizational forms is accomplished by considering organizational performance, individual workload, and the sets of satisfying decision strategies. Author (GRA)

N84-22840# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
A MODEL FOR ASYNCHRONOUS DISTRIBUTED COMPUTATION c64
D. P. Bertsekas *In its* Proc. of the 6th MIT/ONR Workshop on C3 (Command, Control, and Commun.) Systems Dec. 1983 p 39-41 (For primary document see N84-22835 13-32)
(Contract N00014-75-C-1183)
(AD-P002879) Avail: NTIS HC A14/MF A01 CSCL 12/1

This article presents an algorithmic model for distributed computation of fixed points whereby several processors participate simultaneously in the calculations while exchanging information via communication links. It places essentially no assumptions on the ordering of computation and communication between processors thereby allowing for completely uncoordinated execution. It is found that even under these potentially chaotic circumstances it is possible to solve several important classes of problems including the calculation of fixed points of contraction and monotone mappings arising in linear and nonlinear systems of equations, shortest path problems, and dynamic programming. Author (GRA)

N84-22841# Naval Ocean Systems Center, San Diego, Calif.
A UNIFIED APPROACH TO MODELING AND COMBINING OF EVIDENCE THROUGH RANDOM SET THEORY c64
I. R. Goodman *In* MIT Proc. of the 6th MIT/ONR Workshop on C3 (Command, Control, and Commun.) Systems Dec. 1983 p 42-47 (For primary document see N84-22835 13-32)
(AD-P002880) Avail: NTIS HC A14/MF A01 CSCL 12/1

It has been shown in previous work that generalized fuzzy set theory and infinite-valued logic provide a systematic approach to the modeling and use of both natural language and numerical/statistical information which occurs in the tracking-data association and related problems. This paper continues efforts in establishing connections between these disciplines and classical probability theory. It has been shown that over discrete spaces, probabilistic concepts are all special cases of generalized fuzzy set ones. Conversely, many fuzzy set systems can be shown to be natural extensions of ordinary set operators through isomorphic-like relations with corresponding random set representations via one point coverage functions. Among the new results presented here, it is shown that any fuzzy set membership function has naturally compatible random set and random variable representations. In the latter case, the membership function is the same as the evaluation function of the (non-unique) corresponding random variable over a suitably chosen collection of compound- and, in general, overlapping- sets or events. An application to the classification problem is presented. Author (GRA)

N84-22842# Mitre Corp., McLean, Va.
SOFTWARE FOR EXPLICITLY PROBABILISTIC MATHEMATICS c61
S. N. Goldstein *In* MIT Proc. of the 6th MIT/ONR Workshop on C3 (Command, Control, and Commun.) Systems Dec. 1983 p 48-57 (For primary document see N84-22835 13-32)
(AD-P002881) Avail: NTIS HC A14/MF A01 CSCL 09/2

The conventional way to estimate quantities for decision making purposes is to employ informed judgment about the applicable estimating relationships (equations, algorithms, models) and the values of their constituent parameters. More often than not, one or more key parameters are not known with certainty, and informed judgment takes the form of a subjective point estimate (guesstimate). Many practitioners are content to use the resulting point estimate for the result. The more diligent will re-do the calculation combining estimates of upper and lower bounds of the input parameters to estimates of upper and lower limits for the result. Such diligence is facilitated by the increasingly convenient spread sheet computational packages for personal computers. This paper describes software for incorporating uncertainty directly and explicitly into the calculations to yield a probability distribution as the result rather than a set of point estimates. The software permits the user to represent the uncertain parameters by any of about sixteen probability density functions. GRA

N84-22843# Scicon Consultancy International Ltd., London (England).
COMMAND DECISION MAKERS AND THEIR MODES OF INTERACTION c81
P. D. Morgan *In* MIT Proc. of the 6th MIT/ONR Workshop on C3 (Command, Control, and Commun.) Systems Dec. 1983 p 61-66 (For primary document see N84-22835 13-32)
(AD-P002882) Avail: NTIS HC A14/MF A01 CSCL 14/2

An analytic model of the basic decision making process is presented; in this it is shown how external inputs may be employed to reduce the scale of the decision making task, which is represented in the form of a pair of coupled decision making processes. An approach based on control and estimation theory is used in modelling the decision making process; this is supplemented by concepts drawn from knowledge representation and from game tree search. Finally the decision maker is examined as part of a control process in order to identify the relative tempos of different operations and interactions. Author (GRA)

N84-22844# Massachusetts Inst. of Tech., Cambridge.
INFORMATION THEORETIC MODELS OF MEMORY IN HUMAN DECISIONMAKING MODELS c83
S. A. Hall and A. H. Levis *In its* Proc. of the 6th MIT/ONR Workshop on C3 (Command, Control, and Commun.) Systems Dec. 1983 p 67-75 Prepared in cooperation with RCA Astro-Electronics Div., Princeton, N.J. (For primary document see N84-22835 13-32)

(Grant AF-AFOSR-0029-80)
(AD-P002883) Avail: NTIS HC A14/MF A01 CSCL 12/1

Models of memory and information storage useful in the modeling and analysis of decisionmaking with bounded rationality are discussed. An information theoretic model of permanent memory is presented for describing the accessing of stored information by the algorithms within the human decisionmaker model. It is then applied to the study of the performance - workload characteristic of a decisionmaker performing a dual task.
Author (GRA)

N84-22845# Connecticut Univ., Storrs. Dept. of Electrical Engineering and Computer Science.
HUMAN DECISIONMAKING IN DYNAMIC ENVIRONMENTS WITH INCREASING INFORMATION PROCESSING DEMANDS **c81**
D. Serfaty, E. P. Soulsby, and D. L. Kleiman *In* MIT Proc. of the 6th MIT/ONR Workshop on C3 (Command, Control, and Commun.) Systems Dec. 1983 p 76-82 (For primary document see N84-22835 13-32)
(AD-P002884) Avail: NTIS HC A14/MF A01 CSCL 12/1

This article describes the Dynamic Decision Model (DDM) which is a normative-descriptive model that has shown to provide an excellent representation of human information processing and decisionmaking in a dynamic multi-task environment. A sensitivity study was performed on the DDM in an attempt to explore the nature by which various dynamic task attributes affect human performance. In particular, changes in parameters such as the number of concurrent tasks, task velocity, task processing time and task value, were investigated in conjunction with existing notions concerning human operator workload. This global approach not only emphasizes the performance level the human operator may attain but also the tactics and strategies he uses to achieve it.
GRA

N84-22846# ALPHATECH, Inc., Burlington, Mass.
INDIVIDUAL DIFFERENCES IN MILITARY DECISIONMAKING: THE CLASSIFICATION PERFORMANCE OF ACTIVE SONAR OPERATORS **c81**
J. G. Wohl *In* MIT Proc. of the 6th MIT/ONR Workshop on C3 (Command, Control, and Commun.) Systems Dec. 1983 p 83-86 (For primary document see N84-22835 13-32)
(DA Proj. M01-00-PN)
(AD-P002885) Avail: NTIS HC A14/MF A01 CSCL 05/10

The purpose of this paper is to demonstrate the fundamental importance of individual differences among military personnel in their information-seeking and processing behavior when faced with critical decisions in a realistic task. The data reported in this paper were collected at sea in the mid 1960s. The analysis of this data base has provided an object lesson showing the importance of empirical data to decisionmaking research.
Author (GRA)

N84-22847# Navy Personnel Research and Development Center, San Diego, Calif.
DECISION AND DISPLAY ANALYSIS IN A SIMPLE SURVEILLANCE PROBLEM **c81**
F. L. Greitzer and R. L. Hershman *In* MIT Proc. of the 6th MIT/ONR Workshop on C3 (Command, Control, and Commun.) Systems Dec. 1983 p 91-95 (For primary document see N84-22835 13-32)
(AD-P002886) Avail: NTIS HC A14/MF A01 CSCL 05/10

Last year at this workshop the authors reported on human performance in a decision making task posed in terms of target surveillance. The target was either at a previous fix or had moved to a new location offset by a known distance and random angle. The problem was to decide, based on a noisy sample of data, which of these two states was true. To assess human information processing abilities we derived an optimal processor to compare with human performance data. In this report they pursue the relationship between visual and auditory representations of the task and describe effects of alternative representations on human performance.
Author (GRA)

N84-22848# Illinois Univ., Urbana.
THE EFFECTS OF A SPATIAL INFORMATION FORMAT ON DECISION MAKING PERFORMANCE IN A C3 (COMMAND, CONTROL, AND COMMUNICATIONS) PROBABILISTIC INFORMATION INTEGRATION TASK **c82**
B. Scott and C. D. Wickens *In* MIT Proc. of the 6th MIT/ONR Workshop on C3 (Command, Control, and Commun.) Systems Dec. 1983 p 96-99 (For primary document see N84-22835 13-32)
(Contract N00014-79-C-0658)
(AD-P002887) Avail: NTIS HC A14/MF A01 CSCL 09/4

Eight subjects performed a probabilistic information integration task in which multiple cues, and their diagnostic value in choosing between the hypotheses are studied. Primary interest focussed on the comparison of digital and analog-graphical displays, and upon sources of non-optimality in the information integration process. Generally the analog displays proved superior to the digital, and performance was better when information was presented at a more rapid rate. Subjects appeared to be non-optimal in their treatment of reliability vs. diagnosticity. However, departures from optimality related to serial position effects and to the use of the appropriate model of information integration were not observed.
Author(GRA)

N84-22849# Lockheed Electronics Co., Plainfield, N. J.
DEVELOPMENT OF A GENERALIZED HUMAN-MACHINE INTERFACE **c54**
R. E. Knox *In* MIT Proc. of the 6th MIT/ONR Workshop on C3 (Command, Control, and Commun.) Systems Dec. 1983 p 100-105 (For primary document see N84-22835 13-32)
(AD-P002888) Avail: NTIS HC A14/MF A01 CSCL 05/8

The development of a Generalized Human-Machine Interface is driven by consideration of human communication capabilities and limitations. The goal is to develop a system which provides machine capabilities similar to those required for communication among human beings. System features resulting from this approach and incorporated in the design include: application independence, attention monitoring, dynamic device assignment, human performance monitoring, and natural language processing. In addition, a special data management structure has been designed. System architecture and development progress are described.
Author (GRA)

N84-22850# Decision Science Consortium, Inc., Falls Church, Va.
TACTICAL DECISION AIDS WHICH QUANTIFY JUDGMENT **c81**
R. V. Brown and M. S. Cohen *In* MIT Proc. of the 6th MIT/ONR Workshop on C3 (Command, Control, and Commun.) Systems Dec. 1983 p 106-108 (For primary document see N84-22835 13-32)
(Contract N00014-80-C-0046)
(AD-P002889) Avail: NTIS HC A14/MF A01 CSCL 05/10

A new generation of decision aids, based on personalized decision analysis, is being developed to support the judgmental component of tactical command and control systems. They structure and quantify judgments of uncertainty and value, with a view to enhancing the soundness of decisions and reducing the decision maker's burden. Attack submarine examples are presented directed at: assessing target range; alerting to dangers and opportunities; and choosing a time of fire.
Author (GRA)

N84-22851# Virginia Univ., Charlottesville. Dept. of Engineering Science and Systems.
A KNOWLEDGE BASED INTERACTIVE PROCEDURE FOR PLANNING AND DECISION SUPPORT UNDER UNCERTAINTY AND PARAMETER IMPRECISION **c81**
A. P. Sage and C. C. White, III *In* MIT Proc. of the 6th MIT/ONR Workshop on C3 (Command, Control, and Commun.) Systems Dec. 1983 p 109-116 (For primary document see N84-22835 13-32)
(Contract N00014-80-C-0542)
(AD-P002890) Avail: NTIS HC A14/MF A01 CSCL 05/10

This article summarizes key features of an interactive planning and decision support process for multiple criteria alternative selection situations. Probabilities, utility scores for the lowest level

attributes, and attribute tradeoff weights, i.e., the parameters, can be imprecisely described by set inclusion. Within a specified structural model of the decision situation, the process allows the decisionmaker to iteratively select the mix of parameter value precision and alternative ranking specificity. By selecting this mix, the decisionmaker is able to direct and alternative selection process in an interactive manner, using alternative selection strategies based on behaviorally meaningful dominance search strategies. Emphasis is placed on the motivation of the research and the behavioral relevance of the support process. Author (GRA)

N84-22852# Virginia Univ., Charlottesville.
AN EVALUATION OF ARIADNE (ALTERNATIVE RANKING INTERACTIVE AID BASED ON DOMINANCE STRUCTURE INFORMATION ELICITATION) **c81**
C. C. White, III , A. P. Sage, S. Dozono, and W. T. Scherer *In* MIT Proc. of the 6th MIT/ONR Workshop on C3 (Command, Control, and Commun.) Systems Dec. 1983 p 117-121 (For primary document see N84-22835 13-32)
(Contract N00014-80-C-0542)
(AD-P002891) Avail: NTIS HC A14/MF A01 CSCL 05/10

This paper presents the objectives, operational details, results, and conclusions of an evaluation of a decision aiding procedure ARIADNE. The results of the evaluation indicate that ARIADNE, in comparison to a well-known decision aiding procedure called SMART, (1) has a more flexible model of parameter value description that tends to reduce assessment stress and makes ARIADNE more useful in situations where information precision is poor, (2) allows earlier presentation of initial alternative ranking information and (3) allows the decisionmaker to adjust the mix of alternative ranking specificity and parameter value precision.
Author (GRA)

N84-22853# Decision Science Consortium, Inc., Falls Church, Va.
RESEARCH ON COGNITIVE COLLABORATION BETWEEN PERSONS AND COMPUTERS **c54**
M. S. Cohen *In* MIT Proc. of the 6th MIT/ONR Workshop on C3 (Command, Control, and Commun.) Systems Dec. 1983 p 122-128 (For primary document see N84-22835 13-32)
(Contracts N00014-82-C-0138; N00014-80-C-0046)
(AD-P002892) Avail: NTIS HC A14/MF A01 CSCL 05/8

The introduction of decision aids and knowledge-based expert systems incurs resistance when non-congenial styles of problem solving are imposed on users. On-going research addresses the design of computer-based display and analysis systems which cater flexibly to personal styles while providing non-obtrusive safe-guards against potential errors and biases. Capabilities which permit monitoring of the user's task by the computer and of the computer by the user have been explored. Author (GRA)

N84-22854# Naval Ocean Systems Center, San Diego, Calif.
A MAN-MACHINE INTERFACE CONCEPT FOR A STATE-OF-ART, SHIPBOARD, COMMAND/CONTROL CONSOLE **c54**
G. A. Osga *In* MIT Proc. of the 6th MIT/ONR Workshop on C3 (Command, Control, and Commun.) Systems Dec. 1983 p 133-135 (For primary document see N84-22835 13-32)
(AD-P002894) Avail: NTIS HC A14/MF A01 CSCL 05/8

Existing tactical display/control consoles which are located in Combat Information Centers aboard Navy vessels do not take full advantage of existing hardware/software/human factors technology. In addition to limitations imposed by hardware constraints, the user-interface software imposes a difficult-to-learn interface upon the complex task-demands of the command and control environment. The Navy Ocean Systems Center has developed a prototype for a command/control console which features many design advantages in comparison to existing consoles. The new configuration presents a diverse array of human-engineering issues, some specific to this console and others generic to all consoles. An overview of these issues and relevant research conducted at NOSC is presented in this paper. Author (GRA)

N84-22855# Office of Naval Intelligence, Washington, D. C.
MULTI-SENSOR FUSION, COMMUNICATIONS AND INFORMATION WARFARE
D. Schutzer *In* MIT Proc. of the 6th MIT/ONR Workshop on C3 (Command, Control, and Commun.) Systems Dec. 1983 p 139-144 (For primary document see N84-22835 13-32)
(AD-P002895) Avail: NTIS HC A14/MF A01 CSCL 05/2

Todays fusion problems are chiefly concerned with organizational and procedural issues. The technology they employ is mostly available state-of-the-art. The future brings a new set of concerns centered about issues that are more technical in nature. Future military command and control and weapons systems will likely be more distributed, more automated and smarter. They will probably include an advanced form of information warfare where sensing, information exchange, jamming, deception, and misinformation will be capable of being managed and orchestrated from a total mission objective perspective. As a result, the future fusion process will be required to handle and process on orders of magnitude increase in the volume and diversity of input data, faster. It will need to produce a great variety of information to feed automated C2 and weapons systems data bases through more interactive and responsive interfaces than exist today. At the same time it needs to analyze this data at a deeper level of understanding than ever before, scrutinizing and drawing inferences and conclusions about ones adversaries underlying beliefs, readiness, intentions and future actions from what is often times a suspect and spotty data base. Finally, these conclusions and inferences need to be presented in a clear, concise, honest, but convincing and timely manner. This paper presents a unified framework from which the necessary information may be fused, managed and presented to support command in such a future information warfare environment and discusses the associated technical challenges. This paper reviews various ongoing research programs that are addressing these challenges. Author (GRA)

N84-22856# Lincoln Lab., Mass. Inst. of Tech., Lexington.
DISTRIBUTED ESTIMATION IN THE MIT/LL (MASSACHUSETTS INSTITUTE OF TECHNOLOGY/LINCOLN LABORATORY) DSN (DISTRIBUTED SENSOR NETWORKS) TEST-BED
J. R. Delaney, R. T. Lacoss, and P. E. Green *In* MIT Proc. of the 6th MIT/ONR Workshop on C3 (Command, Control, and Commun.) Systems Dec. 1983 p 152-157 (For primary document see N84-22835 13-32)
(AD-P002897) Avail: NTIS HC A14/MF A01 CSCL 17/1

This paper describes the acoustic tracking algorithms currently used in the MIT Lincoln Laboratory (MIT/LL) Distributed Sensor Networks (DSN) test-bed. It discusses the original motivation for inclusion of various features in those algorithms and the lessons learned about those features through experimentation with real and simulated data. Plans for modifications to the detection and tracking algorithms are briefly sketched. A DSN is a surveillance and tracking system employing many geographically dispersed sensor/processor nodes connected by a computer communications network and implemented as a confederacy of identical autonomous cooperating processes. GRA

N84-22857# Advanced Information and Decision Systems, Mountain View, Calif.
DISTRIBUTED ESTIMATION SYSTEMS
C. Y. Chong, S. Mori, and K. Tee *In* MIT Proc. of the 6th MIT/ONR Workshop on C3 (Command, Control, and Commun.) Systems Dec. 1983 p 158-163 Prepared in cooperation with Stanford Univ., Calif. (For primary document see N84-22835 13-32)
(Contract MDA903-81-C-0333)
(AD-P002898) Avail: NTIS HC A14/MF A01 CSCL 17/2

This paper considers the distributed estimation problem by a set of agents connected by an arbitrary communication network. The agents communicate conditional probabilities of the random state over the network. From these conditional probabilities, each agent then tries to re-construct the conditional probability given all the measurements if these were communicated instead of the probabilities. It is discovered that in general the agents have to remember some of the past conditional probabilities and may even

have to request additional information. A method for generating the fusion algorithm for each agent based on the network structure is presented and applied to some examples. The results are applicable to both dynamic and static states. Author (GRA)

N84-22858# ALPHATECH, Inc., Burlington, Mass.
OPTIMAL MANEUVER DETECTION AND ESTIMATION IN MULTIOBJECT TRACKING
T. Kurien, A. Blitz, R. Washburn, and A. Willsky *In* MIT Proc. of the 6th MIT/ONR Workshop on C3 (Command, Control, and Commun.) Systems Dec. 1983 p 164-171 Prepared in cooperation with MIT, Cambridge (For primary document see N84-22835 13-32)
(Contract N00019-82-C-0456)
(AD-P002899) Avail: NTIS HC A14/MF A01 CSCL 12/1

This paper presents an algorithm on the multiobject tracking problem within the framework of a hybrid state estimation problem. This permits the construction of the optimal solution to the multiobject tracking problem. However, due to the exponentially growing storage and computational needs of the algorithm with time, some form of suboptimal approximations have to be made. Since these approximations are made within the framework of the optimal algorithm, the nature and trade-offs associated with the approximations can be examined. Furthermore, optimal and suboptimal algorithms for maneuver detection and estimation can also be incorporated within this framework. The paper is organized as follows. Section 2 formulates the problem of multiobject tracking of maneuvering targets within the framework of the hybrid state estimation problem. The computer implementation of the optimal solution is discussed in Section 3. Suboptimal features that reduce the computational requirements are discussed in Section 4. Section 5 provides some simulation results. GRA

N84-22859# ALPHATECH, Inc., Burlington, Mass.
A FRAMEWORK FOR EVALUATION OF SURVEILLANCE ALGORITHMS **c64**
J. L. Weiss and R. R. Tenney *In* MIT Proc. of the 6th MIT/ONR Workshop on C3 (Command, Control, and Commun.) Systems Dec. 1983 p 178-182 Prepared in cooperation with MIT, Cambridge (For primary document see N84-22835 13-32)
(AD-P002901) Avail: NTIS HC A14/MF A01 CSCL 12/1

The special structure of surveillance systems has been recognized and exploited in the development of relevant mathematical models for some time. These models provide the necessary relationships for applying probabilistic techniques to surveillance problems and therefore determine the complexity of the resulting solutions. Typically, such solutions are very complex and require unreasonably large amounts of memory. For this reason, various algorithms have been developed which restrict the amount of complexity at the possible expense of system performance. The purpose of this paper is to formulate a mathematical framework in which analytical comparison of these algorithms may be performed. GRA

N84-22860# Scicon Consultancy International Ltd., London (England).
THE USE OF RECIPROCAL POLAR CO-ORDINATES IN PASSIVE TRACKING **c64**
A. C. Bamford, E. M. L. Beale, J. Lee, and S. Patel *In* MIT Proc. of the 6th MIT/ONR Workshop on C3 (Command, Control, and Commun.) Systems Dec. 1983 p 198-201 (For primary document see N84-22835 13-32)
(AD-P002906) Avail: NTIS HC A14/MF A01 CSCL 12/1

The use of Reciprocal Polar co-ordinates to parameterize tracks is discussed. Their use makes the problem of determining the characteristics of tracks from bearings only data much less non-linear than the use of the more conventional Cartesian co-ordinates. Author (GRA)

N84-22861# Massachusetts Inst. of Tech., Cambridge.
THE DESIGN OF INFORMATION STRUCTURES: BASIC ALLOCATION STRATEGIES FOR ORGANIZATIONS **c82**
D. A. Stabile and A. H. Levis *In its* Proc. of the 6th MIT/ONR Workshop on C3 (Command, Control, and Commun.) Systems Dec. 1983 p 219-225 Prepared in cooperation with ICF, Inc., Washington, D.C. (For primary document see N84-22835 13-32)
(Contracts N00014-77-C-0532; N00014-83-K-0185; Grant AF-AFOSR-0229-80)
(AD-P002909) Avail: NTIS HC A14/MF A01 CSCL 09/4

The problem of designing the allocation of information processing tasks to organization members who interact with the organization's environment is formulated. Two information strategies are considered for reducing the load on each member while accomplishing the overall task: creation of self contained tasks, and creation of slack resources. The former leads to parallel processing, while the latter is accomplished through alternate processing rules. The two basic strategies can be integrated to produce a wide variety of information structures. Author (GRA)

N84-22862# ALPHATECH, Inc., Burlington, Mass.
INFORMATIONAL ASPECTS OF A CLASS OF SUBJECTIVE GAMES OF INCOMPLETE INFORMATION **c66**
D. Teneketzis and D. A. Castanon *In* MIT Proc. of the 6th MIT/ONR Workshop on C3 (Command, Control, and Commun.) Systems Dec. 1983 p 226-231 (For primary document see N84-22835 13-32)
(Contract N00014-82-C-0693)
(AD-P002910) Avail: NTIS HC A14/MF A01 CSCL 12/1

The key assumptions upon which the development of game theory was initially based are the following: (1) The rules of the game are common knowledge to all the players of the game; (2) The players have the same perception (model) of the game; (3) Players are fully committed to a priori strategies; and (4) Players are rational. Assumptions are quite restrictive as these do not hold in many real-life economic, political, military and other social situations. This is why, as game theory developed, attempts were made to relax some of these assumptions. This paper relaxes and modifies assumptions, and formulates a class of games which shall be called Subjective Games. The players have different perceptions (models) of the game that is being played. It is further assumed that each player considers that the other players have models of the game which is the same as his own model. Moreover, it is deemed that each player is rational within his own subjective view of the decision problem. Under these assumptions, the authors study one-stage games as well as repeated games. GRA

N84-22863# Connecticut Univ., Storrs.
DYNAMIC, HIERARCHICAL DECISION PROBLEMS **c66**
P. B. Luh, T. Ning, and T. S. Chang *In* MIT Proc. of the 6th MIT/ONR Workshop on C3 (Command, Control, and Commun.) Systems Dec. 1983 p 249-254 Prepared in cooperation with State Univ. of New York, Stony Brook (For primary document see N84-22835 13-32)
(Grants NSF ECS-81-05984; AF-AFOSR-0098-80; NSF ECS-82-10673)
(AD-P002912) Avail: NTIS HC A14/MF A01 CSCL 12/1

A hierarchical decision problem with one leader and a continuum of followers is investigated. The problem is formulated as a stochastic Stackelberg game with nonnested information structure, and studied by using the Inducible Region concept. For the single-stage case, it is shown that the inducible region can be delineated, and the optimal Stackelberg strategy can be constructed. These results are then extended to the two-stage case. Although the problem is formulated in a pricing context in terms of companies and customers, the formulation can be interpreted differently to model Command Control and Communications Systems related problems. Author (GRA)

N84-22864# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
OPTIMAL FILE ALLOCATION PROBLEMS FOR DISTRIBUTED DATA BASES IN UNRELIABLE COMPUTER NETWORKS, 2 **c82**
M. H. Ma and M. Athans *In its* Proc. of the 6th MIT/ONR Workshop on C3 (Command, Control, and Commun.) Systems Dec. 1983 p 255-267 (For primary document see N84-22835 13-32)
(AD-P002913) Avail: NTIS HC A14/MF A01 CSCL 09/2

The problem investigated consists of determining the optimal locations of files and the number of redundant copies of these files, in a vulnerable command, control and communications network. It is assumed that each node and link of the communications network can fail independently of the others. The optimization problem maximizes the probability that a commander is able to access the subset of the files that he needs while minimizing the network-wide costs. These network-wide costs are storage costs and costs due to the time delay in query and update requests of the distributed data base system. The problem can be shown to reduce to a zero-one liner programming problem. The authors look for theorems which reduce the complexity of the solution of the zero-one linear programs. Finally a heuristic algorithm has been developed to solve the zero-one linear program. An efficient polynomial time algorithm has been developed for the totally reliable network case. They try to extend the efficient polynomial time algorithm to the unreliable network case. Author (GRA)

N84-22865# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.

CALCULATION PROCEDURES FOR VARIATIONAL, BORN AND EXACT SOLUTIONS FOR ELECTROMAGNETIC SCATTERING FROM TWO RANDOMLY SEPARATED DIELECTRIC RAYLEIGH CYLINDERS

J. A. Krill, R. H. Andreo, and R. A. Farrell Dec. 1983 22 p
(Contract N00024-83-C-5301)
(AD-A138543; JHU/APL/TG-1344) Avail: NTIS HC A02/MF A01 CSCL 20/14

The exact solution, the Born approximation, and its variational improvement are obtained for the scattering of electromagnetic waves from a random ensemble of systems, each consisting of two Rayleigh cylinders. The cylinders are parallel, of infinite length, and of equal radius. Their separation varies randomly among ensemble members except that the cylinders cannot overlap. The intent is to test a recently developed vector stochastic variational principle. The exact solutions are obtained for the average differential scattering cross sections of both the transverse electric (TE) and transverse magnetic (TM) fields relative to the cylinder axes with normal plane wave incidence. The corresponding variational approximations are obtained using a recently reported computational alternative to the more familiar dyadic Green's function solution. They are in essential agreement with the exact TE and TM solutions, whereas the Born results are not. In particular, the variational results accurately account for multiple scattering, which is significant in the exact TE, but not TM, solution, and also account for the difference in geometric polarizability between the two solutions. Author (GRA)

N84-22866# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

TARGET SUPER-RESOLUTION COMPENSATION FOR COHERENT AIRBORNE RADAR UTILIZING SPREAD SPECTRUM WAVEFORMS M.S. Thesis

K. W. Albert Dec. 1983 134 p
(AD-A138545; AFIT/GE/EE/83D-5) Avail: NTIS HC A07/MF A01 CSCL 17/9

Both a coherent and incoherent target filter are compared on an output signal-to-noise power ratio basis. Three spread spectrum waveforms are tested: intrapulse biphase coded, interpulse frequency hopped, and interpulse frequency hopped with subpulse chirp. In all three cases, the incoherent target filter provided superior output power. Typical incoherent/coherent signal power ratios were 1-3 dB, 0.75 dB, and 0.18 dB for the phase coded, FM, and FM with subpulse chirp respectively. Author (GRA)

N84-22867# Hansen (R. C.), Inc., Tarzana, Calif.

FOCAL REGION CHARACTERISTICS OF FOCUSED MICROWAVE ARRAY ANTENNAS Final Report

R. C. Hansen 9 Sep. 1983 105 p
(Contract N00019-82-C-0157)
(AD-A138557; TR-753-2) Avail: NTIS HC A06/MF A01 CSCL 09/5

Fields in the focal region of a focused microwave aperture or array antenna are examined thru detailed calculations. Transverse near field patterns are well behaved with only slightly higher closest sidelobes, and with a rapid sidelobe falloff. Peak axial power density available from an aperture is a function only of distance, but the relationship is non-linear. This relationship and simple formulas alloy system tradeoffs of aperture size, frequency, focal distance and peak power density to be made. Effects of aperture amplitude taper are investigated: uniform excitation gives comparable axial and transverse subsidiary lobes, and is probably the best choice. Taylor tapers give low sidelobes but high forelobes and aftlobes, plus a modest gain degradation. Inverse tapers give low forelobes and aftlobes but very high sidelobes and large gain degradation. A brief comparison of Gaussian, Romberg, and summation calculation methods is given. Author (GRA)

N84-22868# Mitre Corp., Bedford, Mass.

LOCAL NETWORK WIDEBAND INTERCONNECTION ALTERNATIVES Final Report

K. Erat and J. P. Worthley Jan. 1984 77 p
(Contract F19628-82-C-0001)
(AD-A138604; MTR-8563; ESD-TR-83-222) Avail: NTIS HC A05/MF A01 CSCL 17/2

Broadband local area networks are being acquired throughout the Air Force. This report addresses alternatives for interconnecting these networks. These alternatives support both data transmission at rates greater than 1.5 Mbps and two standard television channels. Author (GRA)

N84-22869# Georgia Inst. of Tech., Atlanta.

COMPUTATION OF RADIATION IN STRATIFIED MEDIA BY FAST FOURIER TRANSFORM (FFT) Interim Report, Aug. 1981 - Aug. 1982

J. J. H. Wang Sep. 1983 44 p
(Contract F19628-81-K-0049; AF Proj. 2305)
(AD-A138647; RADC-TR-83-140) Avail: NTIS HC A03/MF A01 CSCL 20/4

A general and universal computational method for the general electro-magnetic problem in stratified media was established. Computations were successfully performed for the field of a horizontal magnetic dipole in a microwave substrate backed by a conducting plane. The general field problem in stratified media was expressed in the form of integrals over k sub rho. The integrands involved Bessel functions which are difficult to integrate. By using the Fast Fourier Transform (FFT) techniques, the integrals are computed numerically. A shortcoming of this method is that its usefulness is limited to near and intermediate fields. This method is applicable to many electromagnetic problems in microwaves, geophysical sciences, printed circuits, etc. Author (GRA)

N84-22870# Northeastern Univ., Boston, Mass.

SIGNAL PROCESSING CIRCUIT DEVELOPMENT Final Technical Report, 1 May 1980 - 31 Dec. 1982

B. L. Cochrun Griffiss AFB, N.Y. RADC Dec. 1983 58 p
(Contract F19628-80-C-0151; AF Proj. 4600)
(AD-A138648; RADC-TR-83-210) Avail: NTIS HC A04/MF A01 CSCL 17/2

This report covers the design, fabrication and evaluation of three testbed modules: Linear imaging 256 element (LIRCCD), Area imaging 32 x 64 (2DIRCCD) and a serial analog delay module (SADL). Author (GRA)

N84-22871# Lincoln Lab., Mass. Inst. of Tech., Lexington.

EVALUATION OF THE COMPREHENSION OF NON-CONTINUOUS, SPED-UP VOCODED SPEECH: A STRATEGY FOR COPING WITH FADING HF (HIGH FREQUENCY) CHANNELS

J. T. Lynch, B. Gold, J. Tierney, and C. J. Bowers 5 Jan. 1984 54 p
(Contract F19628-80-C-0002; AF Proj. 7820)
(AD-A138650; TR-671; ESD-TR-83-230) Avail: NTIS HC A04/MF A01 CSCL 17/2

A novel technique for coping with fading and burst noise on high frequency channels used for digital voice communication has

been developed and evaluated. The technique transmits digital voice only during the high signal-to-noise ratio time intervals, i.e., channel on times, and speeds up the speech when necessary in order to avoid delays which would hinder conversation. The technique was evaluated using a model of the human speech comprehension process, which was tested using a spoken version of a reading comprehension test. The test involved fifteen spoken, two-minute paragraphs processed by a real-time channel vocoder simulation which had been modified to also simulate the on/off characteristics of a fading high frequency channel. Using a speed-up factor of 1.5, the percentage of correct test responses verified the comprehension model. If the average on time is longer than about two seconds or the average channel off time is shorter than about one-half second, then the speech is comprehensible. Since these conditions are met for most disturbed and undisturbed ionospheric conditions, it is concluded that the sped-up speech technique is appropriate for high frequency digital voice communication systems. Author (GRA)

N84-22872# Princeton Univ., N. J. Information Sciences and Systems Lab.
NEARLY OPTIMAL DETECTION OF SIGNALS IN NON-GAUSSIAN NOISE Ph.D. Thesis. Technical Report, Sep. 1981 - Oct. 1983
S. V. Czarnecki and J. B. Thomas Feb. 1984 217 p
(Contract N00014-81-K-0146)
(AD-A138657; TR-14) Avail: NTIS HC A10/MF A01 CSCL 17/8

This dissertation addresses the problem of finding nearly optimal detector structures for non-Gaussian noise environments. It is assumed that the noise statistics are unknown except for a very loose characterization. Under this condition, the goal is to study adaptive detector structures that are simple, yet capable of high levels of performance. Attention is focused on the discrete-time locally optimal detector for a constant signal in independent, identically distributed noise. A definition for non-Gaussian noise is given, several common univariate density models are exhibited, and some physical non-Gaussian noise data is discussed. Two approaches in designing adaptive detector nonlinearities are presented, where it is assumed that the noise statistics are approximately stationary. Both proposals utilized simple measurements of the noise behavior to adapt the detector, and in several examples the adaptive detectors are shown capable of attaining nearly optimal performance levels. A simulation is presented demonstrating their successful application. GRA

N84-22873# SRI International Corp., Menlo Park, Calif.
PROPAGATION EFFECTS IN SATELLITE-BASED SYNTHETIC APERTURE RADARS
C. L. Rino and V. H. Gonzalez 1 Mar. 1983 48 p
(Contract DNA001-81-C-0010; S99-QAXH)
(AD-A138681; AD-E301336; DNA-TR-81-253) Avail: NTIS HC A03/MF A01 CSCL 17/9

This report describes the effects of propagation disturbances on space-based synthetic aperture radars (SAR). Using a model developed earlier, we performed simulations to show the distortion of the radar ambiguity function for the SEASAT-A SAR. For moderate disturbance, an elevated sidelobe level causes a reduction in contrast. The SEASAT-A library of high-latitude data showed examples of this effect, one example of which is analyzed here in detail. GRA

N84-22874# Pennsylvania Univ., Philadelphia. Valley Forge Research Center.
HIGH ANGULAR RESOLUTION MICROWAVE SENSING WITH LARGE, SPARSE, RANDOM ARRAYS Final Scientific Report, 1 Oct. 1981 - 30 Sep. 1983
C. N. Dorny Nov. 1983 235 p
(Grant AF-AFOSR-0012-82; AF Proj. 2305)
(AD-A138717; UP-VFRC-33-83; AFOSR-84-0140TR) Avail: NTIS HC A11/MF A01 CSCL 17/9

This document describes progress toward development of a general capability for high resolution microwave surveillance and imaging using large, sparse, self-cohering arrays. During the last five years progress has been made in the following areas: understanding of the unique advantages of large, self-cohering arrays; development of advances system concepts, including the air-borne radio camera; enhanced self-cohering capability and experimental demonstration of that capability; and development of techniques for improving microwave image quality, including handling of the high sidelobes associated with very sparse arrays. A number of other practical issues associated with large self-cohering arrays have also been examined. GRA

N84-22875# Hazeltine Corp., Greenlawn, N. Y.
STUDY AND DESIGN OF A CYLINDRICAL LENS ARRAY ANTENNA FOR WIDEBAND ELECTRONIC SCANNING Interim Report, Oct. 1980 - Apr. 1982
P. W. Hannan and E. M. Newman Griffiss AFB, N.Y. RADC Dec. 1983 188 p
(Contract F19628-80-C-0110; AF Proj. 4600)
(AD-A138808; RADC-TR-83-128) Avail: NTIS HC A09/MF A01 CSCL 09/5

This Interim Report presents the results of studies leading to the design of a cylindrical lens-array antenna for two-dimensional electronic scanning when the signal has a wide instantaneous bandwidth. The constant-path cylindrical lens defined by Rotman and Franchi is studied for contours, phase aberrations, amplitude distortions, and surface incidence angles. One form of this lens is the R-2R lens, which is chosen for this project. Design of the antenna for low sidelobes is considered. In azimuth, when the beam is scanned off the antenna axis the sidelobes are affected by the curvature of the lens outer surface. In elevation, the sidelobes are affected by feed/lens diffraction. Performance of the electronic-scan antenna with a wideband signal is a function of the number of line feeds that are used to illuminate the cylindrical lens. GRA

N84-22876# Mississippi Univ., University. Dept. of Electrical Engineering.
SCATTERING OF AN ELECTROMAGNETIC PLANE WAVE FROM A PERFECTLY ELECTRICALLY CONDUCTING HALF-PLANE IN THE PROXIMITY OF PLANAR MEDIA DISCONTINUITIES Final Technical Report, 1 Jan. 1980 - 1 Jan. 1983
R. D. Coblin and L. W. Pearson Feb. 1983 233 p
(Contract N00014-81-K-0256)
(AD-A138968) Avail: NTIS HC A11/MF A01 CSCL 20/14

The problem of scattering of electromagnetic waves from a perfectly electrically conducting (PEC) half-plane is a classical problem in the field of electromagnetics and is the basis of the GTD (geometrical theory of diffraction). The application of this theory of modern aerospace structures is hampered due to the presence of media discontinuities which alter the scattering behavior. Therefore, the study of diffraction in the presence of such discontinuities is an important prerequisite to applying the GTD to practical problems. Two related problems are considered in this study which involve planar media discontinuities. The first configuration concerns a planar interface between two semi-infinite, homogeneous media with a PEC half-plane covering half of the interface. The second configurations concerns a dielectric slab embedded in a contrasting medium. On the upper surface of the slab resides a PEC half-plane. Both structures are assumed to be excited by a transverse magnetic plane wave. The boundary value problems are structured as integral equations involving the electric field which is tangential to the interface. GRA

N84-22877# Speech Communication Research Lab., Los Angeles, Calif.
PRELIMINARY ANALYSIS OF AUTOMATIC SPEECH RECOGNITION AND SYNTHESIS TECHNOLOGY Final Report, Jul. 1981 - Dec. 1982
J. Shoup and J. Roberson May 1983 179 p
(Contract MDA904-82-C-0415)
(AD-A138976; USCG-D-20-83) Avail: NTIS HC A09/MF A01 CSCL 17/2

The areas of automatic speech recognition and speech

synthesis are examined to ascertain what possibilities may exist for implementing them in Coast Guard Communication Stations. A discussion of the state of the art in both speech recognition and speech synthesis is presented. Concepts from the disciplines are given, as well as descriptions of many commercially available devices. We do not recommend that the Coast Guard pursue the development of a speech recognition system at this time. Several manufacturers are attempting to develop machines that will meet the Coast Guard's minimum requirements. Quite rapid progress is characteristic of the speech recognition field and suitable systems should be available in a few years. We do recommend that the Coast Guard research the implementation of speech synthesis technology at this time for the following: specific tasks, particularly weather reports, and general purpose use in Communication Stations. GRA

N84-22875# Naval Postgraduate School, Monterey, Calif.
INVESTIGATION OF NON-LINEAR ESTIMATION OF NATURAL RESONANCES IN TARGET IDENTIFICATION M.S. Thesis
C. Y. Chong Dec. 1983 110 p
(AD-A139027; AD-E401136) Avail: NTIS HC A06/MF A01 CSCL 17/9

This investigation considers a non-linear technique for extracting natural resonances from transient electromagnetic scattering responses of radar targets. These natural resonances represent the complex poles of the target's transfer function in the Laplace transform s-plane. The advantage of their use in identification is their dependence only upon the geometry and composition of the target and not upon the aspect and polarization of the incident signal. Based on recent theoretical research, a new signal model has been developed for describing the form of the transient scattering response. This form precludes the optimal use of previous methods for natural resonance extraction based on Prony's algorithm. In this effort, a modified least-squares approach is taken which can accommodate the actual form of the transient signal. The algorithm is tested using simulated signals with various noise levels and conclusions are drawn concerning the viability of the method. Author (GRA)

N84-22879# Centre de Recherches en Physique de l'Environnement, Issy-les-Moulineaux (France).
STUDY OF THE 13 GHz SIGNAL ATTENUATION DUE TO TROPICAL RAINS [ETUDE DE L'AFFAIBLISSEMENT DE PROPAGATION A 13 GHZ DU AUX PRECIPITATIONS TROPICALES]
J. Tiffon Jun. 1982 47 p refs In FRENCH
(CRPE-NT-113) Avail: NTIS HC A03/MF A01

Tropical region atmospheric attenuation distributions for horizontal and vertical polarization, and the ram intensity distribution along the propagation path were studied. Rain attenuation prediction methods for a 19.2 km distance and 13 Ghz frequency were studied. Equiprobability methods give good results.
Author (ESA)

N84-22880# Centre de Recherches en Physique de l'Environnement, Issy-les-Moulineaux (France).
ANALYSIS OF PROPAGATION CONDITIONS AT 20 AND 30 GHz IN EUROPE [ANALYSE DES CONDITIONS DE PROPAGATION A 20 ET 30 GHZ EN EUROPE]
J. Tiffon Nov. 1982 55 p refs In FRENCH
(CRPE-NT-122) Avail: NTIS HC A04/MF A01

Rain attenuation, depolarization and gain due to reception diversity are studied for transmission from a geostationary satellite to Europe in the 20 to 30 6Hz frequency band. These characteristics are established by available date, prevision methods or frequency transposition laws. It is found that the CCIR prevision method is best suited to forecast attenuation in the 20 to 30 6Hz band, and demands the knowledge of the 0.01% rain intensity only. The curves estimating the diversity gain as a function of several parameters are presented. Author (ESA)

N84-22881# Centre de Recherches en Physique de l'Environnement, Issy-les-Moulineaux (France).
COMPRESSION ALGORITHM FOR DATA ANALYSIS IN A RADIO LINK (PREPARATION OF PACEM 2 EXPERIMENT) [ALGORITHME DE COMPRESSION DES DONNEES D'ANALYSE D'UNE LIAISON RADIOELECTRIQUE]
G. Leroux (Institut National des Sciences Appliquees, Lyon) and M. Sylvain Nov. 1982 74 p refs In FRENCH
(CRPE-NT-121) Avail: NTIS HC A04/MF A01

The Hadamard transformation for image compression is applied to a radio data transmission system. The programs used and the performance obtained are described. The algorithms use PASCAL and the listed programs are written in FORTRAN 77. The experimental results of 62 images of 64 lines, show a standard deviation of 1.5% with a compression rate of 18.5, which is in accordance with the proposed goals. Author (ESA)

N84-22882 Syracuse Univ., N. Y.
ELECTROMAGNETIC RADIATION AND SCATTERING FROM A SYSTEM OF CONDUCTING BODIES INTERCONNECTED BY WIRES Ph.D. Thesis
Manuel Filipe Costa 1983 160 p
Avail: Univ. Microfilms Order No. DA8400767

The problem of electromagnetic radiation and scattering from a perfectly conducting system of arbitrarily shaped bodies interconnected by wires is considered. The method of moments is used to solve the electric field integral equation. The bodies are modeled by triangular patches and the wires by a series of straightwire segments. A special vector expansion function is introduced at each of the junction regions. This function is simpler and gives better results than the ones used by previous investigators. The procedure is applicable to both open and closed surfaces. Results are in the form of input impedances, near fields and field patterns. A general-purpose user-oriented computer code is available. Its application domain is quite broad, extending from computer systems composed of several boxes interconnected by coaxial cables to a wide variety of antennas mounted on arbitrarily shaped bodies. There is no theoretical limit to the number of apertures on surfaces of the bodies. Dissert. Abstr.

N84-22883 Maryland Univ., College Park.
ASYMPTOTIC MODELS FOR WAVE SCATTERING FROM VERY ROUGH SURFACES Ph.D. Thesis
Nabajyoti Barkakati 1983 145 p
Avail: Univ. Microfilms Order No. DA8402527

Asymptotic methods are developed that can be used in wave scattering from very rough surfaces. The very rough surface is modeled by either a periodic function or a random process. An asymptotic method for periodic surfaces is illustrated for scalar wave incidence. A second method starts by viewing the scattering problem as one involving wave propagation in a layered random medium. A wave equation for the average scattered field is obtained by an application of the method of smoothing perturbation, and by expanding the average field in powers of epsilon. The solution of the wave equation shows that the scattering from the very rough surface can be characterized by reflection coefficients on the mean plane. Methods of computing the reflection coefficients are derived. The incidence of electromagnetic waves of arbitrary polarization is also considered. The expression for a first order correction to the average field is derived in the case of scalar wave incidence. Dissert. Abstr.

N84-23231# Tohoku Univ., Sendai (Japan).
TRANSMITTING TWO-LEVEL BALANCED CODE WITHIN THE BANDWIDTH OF STRAIGHT BINARY CODE-TRANSMISSION
Ryuichi Sekiya, Tadao M. Nakamura, and Yoshiharu Shigei *In its* The Record of Elec. and Commun. Eng. Conversazione Tohoku Univ., Vol. 52, No. 4 Mar. 1984 p 27-35 refs In JAPANESE; ENGLISH summary (For primary document see N84-23228 13-70)
Avail: NTIS HC A03/MF A01

N84-23525*# Geological Survey, Flagstaff, Ariz.
RADAR BACKSCATTER MODELLING Progress Report.
Gerald G. Schaber, Richard C. Kozak, and Robert L. Gurule *In* NASA. Washington Rept. of Planetary Geology Program, 1983

Apr. 1984 p 268-269 ref (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 17I

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics.*

N84-22884* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
METHOD FOR SEQUENTIALLY PROCESSING A MULTI-LEVEL INTERCONNECT CIRCUIT IN A VACUUM CHAMBER Patent
Donald E. Routh and Gian C. Sharma, inventors (to NASA) (Sharma and Associates, Huntsville, Ala.) Issued 20 Mar. 1984 7 p Filed 19 Aug. 1982
(NASA-Case-MFS-256704-1; US-Patent-4,437,961; US-Patent-Appl-SN-409679; US-Patent-Class-204-192EC) Avail: US Patent and Trademark Office CSCL 09C

An apparatus is disclosed which includes a vacuum system having a vacuum chamber in which wafers are processed on rotating turntables. The vacuum chamber is provided with an RF sputtering system and a dc magnetron sputtering system. A gas inlet introduces various gases to the vacuum chamber and creates various gas plasma during the sputtering steps. The rotating turntables insure that the respective wafers are present under the sputtering guns for an average amount of time such that consistency in sputtering and deposition is achieved. By continuous and sequential processing of the wafers in a common vacuum chamber without removal, the adverse affects of exposure to atmospheric conditions are eliminated providing higher quality circuit contacts and functional device.

Official Gazette of the U.S. Patent and Trademark Office

N84-22885* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THREE PHASE POWER FACTOR CONTROLLER Patent
Frank J. Nola, inventor (to NASA) Issued 21 Feb. 1984 11 p Filed 14 Mar. 1983 Continuation of abandoned US Patent Appl. SN-199765, filed 23 Oct. 1983
(NASA-Case-MFS-25535-2; US-Patent-4,433,276; US-Patent-Appl-SN-476244; US-Patent-Class-318-729; US-Patent-Class-318-798; US-Patent-Class-318-805; US-Patent-Class-318-810; US-Patent-Class-318-438) Avail: US Patent and Trademark Office CSCL 09C

A power control circuit for a three phase induction motor is described. Power factors for the three phases are summed to provide a control signal, and this control signal is particularly filtered and then employed to control the duty cycle of each phase of input power to the motor.

Official Gazette of the U.S. Patent and Trademark Office

N84-22886* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MOTOR POWER CONTROL CIRCUIT FOR ac INDUCTION MOTORS Patent
Frank J. Nola, inventor (to NASA) Issued 27 Mar. 1983 7 p Filed 28 Aug. 1981
(NASA-Case-MFS-25323-1; US-Patent-4,439,718; US-Patent-Appl-SN-297524; US-Patent-Class-318-729; US-Patent-Class-318-812) Avail: US Patent and Trademark Office CSCL 09A

A motor power control of the type which functions by controlling the power factor wherein one of the parameters of power factor current on time is determined by the on time of a triac through which current is supplied to the motor. By means of a positive feedback circuit, a wider range of control is effected.

Official Gazette of the U.S. Patent and Trademark Office

N84-22887* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LOW NOISE TUNED AMPLIFIER Patent
Leonard L. Kleinberg, inventor (to NASA) Issued 13 Mar. 1984 7 p Filed 12 Jun. 1981
(NASA-Case-GSC-12567-1; US-Patent-4,437,069; US-Patent-Appl-SN-373839; US-Patent-Class-330-109; US-Patent-Class-330-277; US-Patent-Class-330-294) Avail: US Patent and Trademark Office CSCL 09A

A bandpass amplifier employing a field effect transistor amplifier first stage is described with a resistive load either a.c. or directly coupled to the non-inverting input of an operational amplifier second stage which is loaded in a Wien Bridge configuration. The bandpass amplifier may be operated with a signal injected into the gate terminal of the field effect transistor and the signal output taken from the output terminal of the operational amplifier. The operational amplifier stage appears as an inductive reactance, capacitive reactance and negative resistance at the non-inverting input of the operational amplifier, all of which appear in parallel with the resistive load of the field effect transistor.

Official Gazette of the U.S. Patent and Trademark Office

N84-22888 ERA Ltd., Leatherhead (England). Power Engineering Div.
AN ASSESSMENT OF THE RELIABILITY OF EDGE CONNECTORS
D. Charman, R. G. Parr, and E. Houghton Mar. 1982 74 p refs (ERA-82-22) Copyright. Avail: Issuing Activity

User views on causes of unreliability in edge connectors used in printed circuit boards were collected and supplemented by practical work. Results show that failures occur with sufficient frequency to be commercially embarrassing; many failures are avoidable, national standards and specifications could be improved and long term solutions to the possible replacement of gold plating should be sought. Author (ESA)

N84-22889*# Hughes Aircraft Co., El Segundo, Calif. Space Communications Group.
ADVANCED NICKEL-HYDROGEN CELL CONFIGURATION STUDY Final Report
Sep. 1983 77 p refs
(Contract NAS3-22249)
(NASA-CR-173417; NAS 1.26:173417) Avail: NTIS HC A05/MF A01 CSCL 10C

Long-term trends in the evolution of space power technology point toward increased payload power demand which in turn translates into both higher battery system charge storage capability and higher operating voltages. State of the art nickel-hydrogen cells of the 50 to 60 Wh size, packaged in individual pressure vessels, are capable of meeting the required cycle life for a wide range of anticipated operating conditions; however, they provided several drawbacks to battery system integrated efforts. Because of size, high voltage/high power systems require integrating hundreds of cells into the operating system. Packaging related weight and volume inefficiencies degrade the energy density and specific energy of individual cells currently at 30 Wh/cudm and 40 Wh/kg respectively. In addition, the increased parts count and associated handling significantly affect the overall battery related costs. Spacecraft battery systems designers within industry and Government realize that to reduce weight, volume, and cost requires increases in the capacity of nickel-hydrogen cells. Author

N84-22890*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RADIATION DAMAGE AND DEFECT BEHAVIOR IN ION-IMPLANTED, LITHIUM COUNTERDOPED SILICON SOLAR CELLS
I. Weinberg, S. Mehta, and C. K. Swartz 1984 11 p refs Presented at the 17th Photovoltaic Spec. Conf., Kissimmee, Fla., 1-4 May 1984; sponsored by IEEE

(NASA-TM-83646; E-2091; NAS 1.15:83646) Avail: NTIS HC A02/MF A01 CSCL 10A

Boron doped silicon n+p solar cells were counterdoped with lithium by ion implanation and the resultant n+p cells irradiated by 1 MeV electrons. The function of fluence and a Deep Level Transient Spectroscopy (DLTS) was studied to correlate defect behavior with cell performance. It was found that the lithium counterdoped cells exhibited significantly increased radiation resistance when compared to boron doped control cells. It is concluded that the annealing behavior is controlled by dissociation and recombination of defects. The DLTS studies show that counterdoping with lithium eliminates at least three deep level defects and results in three new defects. It is speculated that the increased radiation resistance of the counterdoped cells is due primarily to the interaction of lithium with oxygen, single vacancies and divacancies and that the lithium-oxygen interaction is the most effective in contributing to the increased radiation resistance. E.A.K.

N84-22891*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ADVANCES IN SOLID STATE SWITCHGEAR TECHNOLOGY FOR LARGE SPACE POWER SYSTEMS

Gale R. Sundberg 1984 20 p refs To be presented at the 19th Intersoc. Energy Conversion Eng. Conf., San Francisco, 19-24 Aug. 1984

(NASA-TM-83652; E-2096; NAS 1.15:83652) Avail: NTIS HC A02/MF A01 CSCL 09C

High voltage solid state remote power controllers (RPC's) and the required semiconductor power switches to provide baseline technology for large, high power distribution systems in the space station, all electric airplane and other advanced aerospace applications were developed. The RPC's were developed for dc voltages from 28 to 1200 V and ac voltages of 115, 230, and 440 V at frequencies of 400 Hz to 20 kHz. The benefits and operation of solid state RPC's and highlights of several developments to bring the RPC to technology readiness for future aerospace needs are examined. The 28 V dc Space Shuttle units, three RPC types at 120 V dc, two at 270/300 V dc, two at 230 V ac and several high power RPC models at voltages up to 1200 V dc with current ratings up to 100 A are reviewed. New technology programs to develop a new family of (DI)2 semiconductor switches and 20 kHz, 440 V ac RPC's are described. E.A.K.

N84-22892*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

DEVELOPMENT OF HIGH FREQUENCY LOW WEIGHT POWER MAGNETICS FOR AEROSPACE POWER SYSTEMS

Gene E. Schwarze 1984 13 p refs To be presented at the 19th Intersoc. Energy Conversion Eng. Conf., San Francisco, 19-24 Aug. 1984

(NASA-TM-83656; E-2043; NAS 1.15:83656) Avail: NTIS HC A02/MF A01 CSCL 09C

A dominant design consideration in the development of space type power mangetic devices is the application of reliable thermal control methods to prevent device failure which is due to excessive temperature rises and hot temperatures in critical areas. The resultant design must also yield low weight, high efficiency, high reliability and maintainability, and long life. The weight savings and high efficiency that results by going to high frequency and unique thermal control techniques is demonstrated by the development of a 25 kVA, 20 kHz space type transformer under the power magnetics technology program. Work in the area of power rotary transformer is also discussed. E.A.K.

N84-22893# Pennsylvania State Univ., University Park. Dept. of Electrical Engineering.

ELECTRICAL, CHEMICAL, AND MICROSTRUCTURAL CHARACTERIZATION OF GETTERING MECHANISMS FOR VLSI (VERY LARGE SCALE INTEGRATED CIRCUITS) Final Report, 30 Sep. 1980 - 29 Sep. 1983

J. R. Stach Sep. 1983 9 p

(Contract DAAG29-80-K-0085)

(AD-A138662; ARO-17546.3-MS) Avail: NTIS HC A02/MF A01 CSCL 09/1

An investigation was made of a number of gettering techniques particularly important for VLSI processing. These techniques have included back surface gettering, intrinsic gettering, and HCl oxidation. The general approach of the investigation was to concentrate on the fundamental mechanisms involved with each of the gettering techniques, looking not only at the electrical implications of the technique, but also be the chemical and microstructural properties. GRA

N84-22894# JAYCOR, San Diego, Calif.

LATCHUP WINDOW TESTS

J. Azarewicz and W. Hardwick 1 Feb. 1983 86 p

(Contract DNA001-81-C-0281; X99-QAXV)

(AD-A138680; AD-E301334; JAYCOR-J200-82-447-2249; DNA-TR-81-56) Avail: NTIS HC A05/MF A01 CSCL 09/5

This report addresses the very important issue of latchup windows in integrated circuits. This is a serious problem and requires careful consideration in each individual case of system design. Latchup may cause system failure through burnout of the device or through an upset of the circuit in which latchup occurs. The existence of a latchup window was first reported by researchers performing latchup testing of MOS integrated circuits (Refs. 1,2). It was found that latchup would occur in some devices for only a small range of dose rates. At dose rates below a critical value, the device would not experience latchup. A second higher dose rate range was found where latchup would again not occur. These tests were performed using high-energy electrons (Linac) and were performed on CMOS, CD4000 series devices. GRA

N84-22895# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

THE DEVELOPMENT AND FABRICATION OF AN IMPLANTABLE, MULTIPLEXED, SEMICONDUCTOR MULTIELECTRODE ARRAY M.S. Thesis

R. B. Ballantine Dec. 1983 151 p

(AD-A138788; AD-F300387; AFIT/GE/EE/83D-9) Avail: NTIS HC A08/MF A01 CSCL 09/1

A new JFET multielectrode array, consisting of a four by four array and sixteen junction field effect transistors, has been fabricated. Changes in the fabrication processes include: The use of three inch wafers, in lieu of one and one quarter inch wafers; positive photoresist, instead of negative photoresist; different impurity sources; different diffusion times and temperatures; and a two metal metallization layer, versus a four metal metallization layer. In addition, two unique NMOS multiplexer circuits have been designed for use with either the JFET multielectrode array, or an NMOS multielectrode array. The first multiplexer circuit contains a count-selectable counter, a one of sixteen output multiplexer, a decoder for generating a sync signal, and sixteen by sixteen multielectrode array, all on a single chip. In addition, the array can be separated from the chip permitting the use of the remaining circuitry with other types and sizes of arrays. The second multiplexer circuit contains the same features of the first multiplexer, plus an additional one of sixteen output multiplexer and a four-bit counter. With this chip, however, the array can not be separated from the remaining circuitry. Author (GRA)

N84-22896# Geo-Centers, Inc., Newton, Mass.

USE OF A POLYACETYLENE CATHODE IN PRIMARY LITHIUM-THIONYL CHLORIDE CELLS

Oct. 1983 64 p

(Contract N00014-82-C-2233)

(AD-A138791; AD-E001670; GC-TR-83-281) Avail: NTIS HC A04/MF A01 CSCL 10/3

This report describes the work performed for the Navy with regard to the use of poly(acetylene), (CH)x, as a cathode material in a lithium/thionyl (Li/SOC12) battery. The objective of the project was three fold: (1) To characterize and understand the electrochemistry of (CH)x in a detailed manner, (2) To study the compatibility of (CH)x with SOC12 and (3) To synthesize and investigate modified

(CH)x polymers which may possess more desirable properties than the parent polymer. GRA

N84-22897# Aerospace Corp., El Segundo, Calif. Materials Sciences Lab.
ENVIRONMENTAL QUALIFICATION TESTS, SIGNAL CONDITIONING UNIT, SD802 MATERIALS EXPERIMENT
A. F. DiGiacomo, W. C. Burns, and P. Schall 1 Dec. 1983 53 p (Contract F04701-83-C-0084)
(AD-A138910; TR-0084(4935-05)-1; SD-TR-83-77) Avail: NTIS HC A04/MF A01 CSCL 09/5

The vibration qualification test described within this report completes the vibration qualification requirements as established by the LDEF Project Office for flight hardware association with the SD802 materials experiment. The combined environment temperature altitude test described was completed to establish the operating stability of electronic components within the signal conditioning electronic units (SCUs). Author (GRA)

N84-22898# Argonne National Lab., Ill. Chemical Technology Div.
RESISTANCE CHARACTERIZATION OF NICKEL SULFIDE ELECTRODES IN LICI-CONTAINING MOLTEN SALT ELECTROLYTES
Laszlo Redey and Donald Vissers 1983 11 p refs Presented at the Electrochem. Soc. Fall Meeting, Washington, 9 Oct. 1983 (Contract W-31-109-eng-38)
(DE84-006734; CONF-831086-12) Avail: NTIS HC A02/MF A01

The electrode kinetics of a high area loading: (545.6 mAh/cm(2) for the Ni reversible NiS transition), porous nickel sulfide electrode were studied under one-dimensional current distribution in a half-cell-type test arrangement. Area-specific resistance values (ASR/sub t/) were measured under wide variety of conditions: temperature, 450 to 490(0)C; current density, 0.01 to 3A/cm(2); and mechanical stress, 0.11 to 1.68 kg/cm(2). The ASR/sub t/ values were used for quantitative characterization of the ohmic-related and electrochemical-related resistances of the electrode bed. When cycled in the Ni reversible NiS transition range, the electrode showed good utilization and excellent power characteristics in an all-lithium-cation (LiF-LiCl-LiBr) electrolyte. Capability of continuous cycling at high rates (up to 800 mA/cm(12) was demonstrated. The performance of the electrode was also found to be dependent on the mechanical stress developed in the electrode. DOE

N84-22899# Varian Associates, Palo Alto, Calif.
60 GHz GYROTRON DEVELOPMENT PROGRAM Quarterly Report, Apr. - Jun. 1983
H. R. Jory, R. E. Bier, L. J. Craig, K. L. Felch, L. J. Fox, G. Hu, H. E. Huey, and S. T. Spang 1983 95 p refs
(Contract W-7405-eng-26)
(DE84-006606; ORNL/SUB-79-21453/16; QR-16) Avail: NTIS HC A05/MF A01

The objective is to develop a microwave oscillator capable of producing 200 kW of CW power at 60 GHz. Additional calculations for stepped cavity designs are reported. The work on collector fatigue improvement has continued. Testing of X-6 results in operation at CW output power in the range of 200 to 206 kW for a time period of one hour. This satisfies one of the program's major milestones and represents a new world record for CW power at frequencies above 28 GHz. DOE

N84-22900 Tennessee Univ., Knoxville.
STATE-SPACE STRUCTURES FOR THE REALIZATION OF LOW ROUNDOFF NOISE DIGITAL FILTERS Ph.D. Thesis
Bruce William Bomar 1983 300 p
Avail: Univ. Microfilms Order No. DA8402717

The synthesis of computationally efficient low roundoff noise, L(2) norm scaled, state space realizations for fixed point recursive digital filters is studied. In addition to low roundoff noise, such realizations also possess low coefficient sensitivity and low likelihood of sustaining overflow oscillations. The theory of state space structures is reviewed, techniques for synthesizing minimum roundoff noise state space structures are reviewed, techniques for synthesizing minimum roundoff noise state space structures are discussed, and a new technique for synthesizing n(th) order minimum noise structures is introduced. Extension of the technique to state decimation realizations is considered. Two new n(th) order state space structures are proposed. Several new second order filter structures are also introduced. An approach to developing simple algebraic, real arithmetic design equations for scaled second order structures is presented and then applied to deriving design equations for the new structures and for the minimum noise and normal structures. Dissert. Abstr.

N84-22901 North Carolina State Univ., Raleigh.
PARAMETRIC AND NONPARAMETRIC FAST KALMAN ECHO CANCELLATION Ph.D. Thesis
Sasan Houston Ardalan 1983 122 p
Avail: Univ. Microfilms Order No. DA8402082

A fast converging echo canceller is developed and theoretically analyzed. The parametric algorithm is based on the pole/zero modeling of the echo path rather than the conventional tapped delay line model (nonparametric model). Since the parametric algorithm models the finite order echo path exactly with a short state estimate vector; very fast convergence with a high degree of cancellation was achieved. A theoretical analysis of the Fast Kalman and the conventional gradient search echo cancellers is presented. The analysis shows that the Fast Kalman echo cancellar's rate of convergence is independent of speech correlation properties while the gradient search echo canceller's rate of convergence is highly dependent on the eigenvalues of the speech autocorrelation matrix over the state estimate vector length. Dissert. Abstr.

N84-22902 Duke Univ., Durham, N. C.
THE SYNTHESIS AND VALIDATION OF EXPERIMENTAL VLSI DESIGN USING DECOUPLED BEHAVIORAL, STRUCTURAL AND PHYSICAL SPECIFICATIONS Ph.D. Thesis
John Anthony Dallen, Jr. 1983 316 p
Avail: Univ. Microfilms Order No. DA8401998

The era of VLSI has transformed the discipline of integrated circuit design into digital systems design. The complexity of these systems has been the primary hindrance in taking advantage of VLSI potential. A myriad of design approaches and design techniques were both suggested and implemented for VLSI design, but as of this time an optimal design methodology is not known. Nowhere is the problem more acute than in the domains of custom and experimental design. To address this challenge a strategy is defined for the design of custom and experimental VLSI systems. To place this strategy in perspective, a structure is presented by which alternative design methodologies and design languages are categorized. With this structure, different levels of design abstraction are defined and different design representations are identified as having behavioral, structural and/or physical properties. Using this structure, the requirements for a design strategy are generated, including a multilevel, technology-independent design language that supports hierarchical design. Dissert. Abstr.

N84-22780# Joint Publications Research Service, Arlington, Va.
EXPERIENCE WITH DEVELOPMENT OF SEALED LINEAR WAVEGUIDE ELECTRON ACCELERATORS Abstract Only
Ye. V. Suvorov and A. I. Khaustov *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 7 Transl. into ENGLISH from Pribory i Tekhn. Eksperimenta (Moscow), no. 5, Sep. - Oct. 1983 p 11-13 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

N84-23227# Joint Publications Research Service, Arlington, Va.
THOMSON SEMICONDUCTORS BIPOLAR IC STRATEGY TO 1986
J. P. DellaMussia *In its* West Europe Rept.: Sci. and Technol. (JPRS-WST-84-011) 9 Apr. 1984 p 33-36 Transl. into ENGLISH from Electron. Actualites (France), 24 Feb. 1984 p 1, 15 (For

primary document see N84-23224 13-70)
Avail: NTIS HC A03/MF A01

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

N84-22903* National Aeronautics and Space Administration. Pasadena Office, Calif.
RADIATIVE COOLER Patent
Stanley W. Petrick (California Inst. of Tech., Pasadena) and Ramon D. Garcia, inventors (to NASA) (California Inst. of Tech., Pasadena) Issued 3 Jan. 1984 7 p Filed 17 Jul. 1981 Sponsored by NASA
(NASA-Case-NPO-15465-1; US-Patent-4,423,605; US-Patent-Appl-SN-284289; US-Patent-Class-62-467R; US-Patent-Class-62-264; US-Patent-Class-62-DIG.1; US-Patent-Class-126-417; US-Patent-Class-165-135; US-Patent-Class-165-DIG.6) Avail: US Patent and Trademark Office CSCL 20D

A method and radiative cooling device for use in passively cooling spaces is described. It is applicable to any level of thermal radiation in vacuum and to high-intensity thermal radiation in non-vacuum environments. The device includes an enclosure nested in a multiplicity of thin, low-emittance, highly-reflective shields. The shields are suspended in a casing in mutual angular relation and having V-shaped spaces defined therebetween for redirecting, by reflection, toward the large openings of the V-shaped spaces, thermal radiation entering the sides of the shields, and emitted to the spaces, whereby successively reduced quantities of thermal radiation are reflected by the surfaces along substantially parallel paths extended through the V-shaped spaces to a common heat sink such as the cold thermal background of space.
Official Gazette of the U.S. Patent and Trademark Office

N84-22904 British Aerospace Dynamics Group, Bristol (England). Aerodynamics Research Dept.
VISUALISATION OF THE VORTEX DOMINATED FLOW AROUND A DELTA WING-BODY COMBINATION USING A WATER TUNNEL
H. P. Swaby 27 Nov. 1980 41 p refs
(BAe-821/RES/6631) Avail: Issuing Activity

Interaction of the body vortex system and the wing panels in vortex dominated flow around a cruciform wing/body combination at angles of incidence up to 35 deg was studied using dye lines in a water tunnel with flow speed = 5 to 10 cm/sec, Reynolds number based on body diameter = 1700. Photographs show anticipated differences in the flow field for a delta, as opposed to a cropped delta wing-body configuration. A strong wing leading edge vortex is present with the delta wing combination. The vortex does not break up when the body attitude is such that there is a low effective angle of attack on the upper wing panel, but when the body is at low incidence with zero roll angle, or at higher incidence with the wings rolled to the leeside. The flow remains rotational. Author (ESA)

N84-22905# National Mechanical Engineering Research Inst., Pretoria (South Africa). Special Projects Div.
WORK CAPSULE FOR LIGHTWEIGHT HYDROSTATIC MACHINES
M. S. Hunt Feb. 1983 16 p
(CSIR-RR-581; ISBN-0-7988-2377-1) Avail: NTIS HC A02/MF A01

The theoretical feasibility of designing a lightweight flexible capsule suitable for use as the basic actuating means in the place of the conventional piston and cylinder in a high pressure hydrostatic machine was investigated. The idea was suggested by the high strength/modulus ratio obtained with glass fiber reinforced composites. It is found that the combined effect of hoop and bend stresses in the flexible walls of a bellows type capsule imposes severe limitations on the work output of the capsule. S.L.

N84-22906*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
AN ANALYSIS OF SHOCK COALESCENCE INCLUDING THREE-DIMENSIONAL EFFECTS WITH APPLICATION TO SONIC BOOM EXTRAPOLATION Ph.D. Thesis - George Washington Univ.
Christine M. Darden Jan. 1984 77 p refs
(NASA-TP-2214; L-15660; NAS 1.60:2214) Avail: NTIS HC A05/MF A01 CSCL 20D

A method for analyzing shock coalescence which includes three dimensional effects was developed. The method is based on an extension of the axisymmetric solution, with asymmetric effects introduced through an additional set of governing equations, derived by taking the second circumferential derivative of the standard shock equations in the plane of symmetry. The coalescence method is consistent with and has been combined with a nonlinear sonic boom extrapolation program which is based on the method of characteristics. The extrapolation program, is able to extrapolate pressure signatures which include embedded shocks from an initial data line in the plane of symmetry at approximately one body length from the axis of the aircraft to the ground. The axisymmetric shock coalescence solution, the asymmetric shock coalescence solution, the method of incorporating these solutions into the extrapolation program, and the methods used to determine spatial derivatives needed in the coalescence solution are described. Results of the method are shown for a body of revolution at a small, positive angle of attack. E.A.K.

N84-22907*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
HYBRID PERTURBATION/BUBNOV-GALERKIN TECHNIQUE FOR NONLINEAR THERMAL ANALYSIS
Ahmed K. Noor (George Washington Univ.) and Chad D. Balch (George Washington Univ.) Jun. 1983 28 p refs
(NASA-TP-2145; L-15584; NAS 1.60:2145) Avail: NTIS HC A03/MF A01 CSCL 20D

A two step hybrid analysis technique to predict the nonlinear steady state temperature distribution in structures and solids is presented. The technique is based on the regular perturbation expansion and the classical Bubnov-Galerkin approximation. The functions are obtained by using the regular perturbation method. These functions are selected as coordinate functions and the classical Bubnov-Galerkin technique is used to compute their amplitudes. The potential of the proposed hybrid technique for the solution of nonlinear thermal problems is discussed. The effectiveness of this technique is demonstrated by the effects of conduction, convection, and radiation modes of heat transfer. It is indicated that the hybrid technique overcomes the two major drawbacks of the classical techniques: (1) the requirement of using a small parameter in the regular perturbation method; and (2) the arbitrariness in the choice of the coordinate functions in the Bubnov-Galerkin technique. The proposed technique extends the range of applicability of the regular perturbation method and enhances the effectiveness of the Bubnov-Galerkin technique.
E.A.K.

N84-22908*# Continuum, Inc., Huntsville, Ala.
MICROCOMPUTER NUMERICAL ANALYSIS SYSTEM FOR GAS DYNAMICS APPLICATION Final Report
Robert J. Prozan 18 Jun. 1983 6 p ref
(Contract NAS8-34592)
(NASA-CR-171005; NAS 1.26:171005) Avail: NTIS HC A02/MF A01 CSCL 20D

The original objective (scope) of the effort was to deliver a microcomputer version of the Continuum gas dynamic numerical analysis on existing NASA equipment. It became apparent during the course of the contract that the interests of NASA would be much better served by the delivery of a dedicated system designed and developed by Continuum, which would provide NASA with

additional hardware ideally suited to the specific task at no increase in cost. Accordingly, the contract was modified to reflect this new development. The details of the modification and the delivered capability will be discussed in greater detail in the ensuing technical discussion. Author

N84-22909*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
VORTEX GENERATING FLOW PASSAGE DESIGN FOR INCREASED FILM-COOLING EFFECTIVENESS AND SURFACE COVERAGE
S. Stephen Papell 1984 21 p refs Presented at the 22nd Natl. Heat Transfer Conf., Niagara Falls, N.Y., 5-8 Aug. 1984; sponsored by ASME and the American Inst. for Chemical Engineering.
(NASA-TM-83617; E-2048; NAS 1.15:83617) Avail: NTIS HC A02/MF A01 CSCL 20D

The fluid mechanics of the basic discrete hole film cooling process is described as an inclined jet in crossflow and a cusp shaped coolant flow channel contour that increases the efficiency of the film cooling process is hypothesized. The design concept requires the channel to generate a counter rotating vortex pair secondary flow within the jet stream by virture of flow passage geometry. The interaction of the vortex structures generated by both geometry and crossflow was examined in terms of film cooling effectiveness and surface coverage. Comparative data obtained with this vortex generating coolant passage showed up to factors of four increases in both effectiveness and surface coverage over that obtained with a standard round cross section flow passage. A streakline flow visualization technique was used to support the concept of the counter rotating vortex pair generating capability of the flow passage design. M.G.

N84-22910*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AERODYNAMIC EFFECT OF COMBUSTOR INLET-AIR PRESSURE ON FUEL JET ATOMIZATION
Robert D. Ingebo 1984 18 p refs Proposed for presentation at the 20th Joint Propulsion Conf., Cincinnati, 11-13 Jun. 1984; sponsored by AIAA, SAE, and ASME
(NASA-TM-83611; E-2034; NAS 1.15:83611) Avail: NTIS HC A02/MF A01 CSCL 20D

Mean drop diameters were measured with a recently developed scanning radiometer in a study of the atomization of liquid jets injected cross stream in high velocity and high pressure airflows. At constant inlet air pressure, reciprocal mean drop diameter, was correlated with airflow mass velocity. Over a combustor inlet-air pressure range of 1 to 21 atmospheres, the ratio of orifice to mean drop diameter, D(O)/D(M), was correlated with the product of Weber and Reynolds number, WeRe, and with the molecular scale momentum transfer ratio of gravitational to inertial forces. M.A.C.

N84-22911*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HEAT TRANSFER IN SERPENTINE PASSAGES WITH TURBULENCE PROMOTERS
Robert J. Boyle 1984 16 p refs Proposed for presentation at the 22nd Natl. Heat Transfer Conf., 5-8 Aug. 1984; sponsored by ASME and AIChE
(NASA-TM-83614; E-2040; NAS 1.15:83614) Avail: NTIS HC A02/MF A01 CSCL 20D

Local heat transfer rates and overall pressure losses were determined for serpentine passages of square cross section. The flow entered an inlet leg, turned 180 deg and then passed through an outlet leg. Results were obtained for a passage with smooth walls for three different bend geometries and the effect of turbulence promoters was investigated. Turbulence promoters between 0.6 and 15% of the passage height were tested. Local heat transfer rates are determined from thermocouple measurements on a thin electrically heated Inconel foil and pressure drop is measured along the flow path. E.A.K.

N84-22912*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
BELLOWS FLOW-INDUCED VIBRATIONS
P. J. Tygielski, H. M. Smyly, and C. R. Gerlach (Gerlach Products, Inc.) Oct. 1983 229 p refs
(NASA-TM-82556; CDDF:80-5; NAS 1.15:82556) Avail: NTIS HC A11/MF A01 CSCL 20D

The bellows flow excitation mechanism and results of comprehensive test program are summarized. The analytical model for predicting bellows flow induced stress is refined. The model includes the effects of an upstream elbow, arbitrary geometry, and multiple piles. A refined computer code for predicting flow induced stress is described which allows life prediction if a material S-N diagram is available. E.A.K.

N84-22913*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
TURBULENCE MODELING
J. D. Murphy Mar. 1984 56 p refs
(NASA-TM-85889; A-9645; NAS 1.15:85889) Avail: NTIS HC A04/MF A01 CSCL 20D

A survey designed to provide an introduction to the subject of turbulence modeling, and to explain the need for such models is given. The subject is developed along chronological lines since this provides a logical development plan and also because it then moves from relatively simple phenomenological models through more complicated procedures and ultimately to the subject of large-eddy simulation. R.J.F.

N84-22914# California Univ., Berkeley. Dept. of Mechanical Engineering.
THE CHANGING SCENE IN COMPUTATIONAL FLUID DYNAMICS Interim Report
M. Holt Aug. 1983 19 p Presented at the Computational Tech. Conf., Syndey, 28 - 31 Aug. 1983
(Grant AF-AFOSR-0230-80; AF Proj. 2307)
(AD-A138661; AFOSR-84-0115TR) Avail: NTIS HC A02/MF A01 CSCL 20/4

The evolution of numerical techniques for solving problems in Fluid Dynamics is followed, in outline, from the days when Digital Computers were first available, at the end of the Second World War, to the present time, when the Computer Aerodynamic Simulator is being assembled. In this period the range of numerical methods has been broadened five fold, while the speed and capacity of computers have increased by several orders of magnitude. Two areas close to the author's interests are selected to illustrate these changes. The first concerns the extension of the Method of Integral Relations to apply to laminar and turbulent boundary layer problems, including internal flows, separated flows and turbulent mixing flows. The second area deals with unsteady inviscid compressible flow in one or more dimensions and a discussion is given of the relative merits of Godunov and Glimm techniques. Author (GRA)

N84-22915# Washington Univ., Seattle. Dept. of Aeronautics and Astronautics.
MIXING OF SWIRLING FLOWS AND BEHAVIOR OF WET FLOWS Annual Report, 1 May 1982 - 30 Apr. 1983
G. C. Oates 22 Nov. 1983 7 p
(Grant AF-AFOSR-0186-80; AF Proj. 2307)
(AD-A138697; AFOSR-84-0108TR) Avail: NTIS HC A02/MF A01 CSCL 20/4

This report describes progress into research on the interaction of droplets with shock waves, the mixing of co-axial jets in the near region, the influence of nearby solid boundaries on multihole probes, and the behavior of shock trains in ramjet inlets. The study of the mixing of coaxial jets has been completed with the submission of a Ph.D. dissertation. Appropriate software for laser velocimetry data reduction has been prepared for use with the droplet-shock wave study, and a computer program for the description of droplet shock wave interaction has been generated. Preliminary measurements of solid boundary influence on five hole probe readings have been taken, and optical data for shock trains

in ramjet inlets have been obtained from both a water analogy rig and a supersonic wind tunnel. GRA

N84-22916# Rutgers - The State Univ., New Brunswick, N. J. Dept. of Mechanical Industrial and Aerospace Engineering.
THEORETICAL INVESTIGATION OF THREE-DIMENSIONAL SHOCK WAVE-TURBULENT BOUNDARY LAYER INTERACTIONS, PART 2 Annual Interim Report, 1 Oct. 1982 - 30 Sep. 1983
D. D. Knight Dec. 1983 71 p
(Grant AF-AFOSR-0040-82; AF Proj. 2307)
(AD-A138722; RU-TR-160-MAE-F; AFOSR-84-0113TR) Avail: NTIS HC A04/MF A01 CSCL 20/4

The focus of the research effort is the understanding of three-dimensional shock wave-turbulent boundary layer interactions. The approach uses the full mean compressible Navier-Stokes equations with turbulence incorporated through the algebraic turbulent eddy viscosity model of Baldwin and Lomax. During the present year of the research effort, the three-dimensional shock boundary layer interaction generated by a 10 deg sharp fin has been computed at Mach 3 for a Reynolds number 280000. These results, together with previous computations of the same configuration at Reynolds number = 930000, are compared with experimental data for pitot pressure and yaw angle. The agreement with the experimental data is good, and the theory accurately predicts the recovery of the boundary layer downstream of the interaction of Reynolds number = 280000. The computed flowfield is employed to analyze the structure of the 3-D interaction through contour plots of flow variables. Also, during the present year, the investigation of the 2-D turbulent supersonic compression corner at Mach 3 was completed. The relaxation modification to the Baldwin-Lomax model was found to yield reasonably accurate predictions of the upstream propagation of the surface for the Reynolds number range investigated. An additional computation at Mach 2 was performed, and the results were in general agreement with the previous conclusions. Author (GRA)

N84-22917# Lehigh Univ., Bethlehem, Pa. Dept. of Mechanical Engineering and Mechanics.
EXPERIMENTAL OBSERVATIONS OF VORTEX RING INTERACTION WITH THE FLUID ADJACENT TO A SURFACE Interim Report
A. W. Cerra, Jr. and C. R. Smith Oct. 1983 189 p
(Contract F49620-78-C-0071; AF Proj. 2307)
(AD-A138999; FM-4; AFOSR-84-0130TR) Avail: NTIS HC A09/MF A01 CSCL 20/4

Experimental studies examined the breakdown of initially laminar vortex rings during impact with both solid and free surfaces in a quiescent environment, and with a solid surface beneath a developing laminar boundary layer. Flow interactions were visualized in water using dye and hydrogen-bubble techniques and recorded with a high-speed video system. When a vortex ring approaches a surface the resulting flow interaction appears to be chaotic and turbulent, but is actually a very organized viscid-inviscid process which rapidly disperses the vorticity of the vortex ring throughout the surrounding fluid. Described is the flow interaction which integrates the following phenomena: (1) generation of secondary vorticity of opposite sense to that of the vortex ring; (2) deviations in the trajectory of the vortex ring from that predicted by classical theory; and (3) the processes of organized dispersal of vorticity. The process by which vorticity dispersal occurs is dependent upon the initial Reynolds number (Re sub 0) of the vortex ring. For very weak rings, i.e., Re sub o less than 350, vorticity is dispersed by laminar diffusion. For stronger rings, vorticity dispersal occurs discretely through formation of secondary and tertiary vortex rings (SVR and TVR) via a viscous boundary layer process. Vorticity dispersal continues as a result of Biot-Savart-type interactions of the SVR and TVR with the original or primary vortex ring. During this interaction the diameter of the SVR is compressed, causing an instability in the SVR which is characterized by an azimuthal waviness. GRA

N84-22918# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE CALCULATION OF THE HEAT TRANSFER ASSOCIATED WITH THE INJECTION OF METHANE GAS AT THE STAGNATION POINT OF THE DISSOCIATED BOUNDARY LAYER OF THE LAMINAR AIR FLOW
Y. Longhua and Y. Xintian 9 Feb. 1984 22 p Transl. into ENGLISH from Gongcheng Rewuli Xuebao (China), v. 3, No. 4, 1982 p 379-385
(AD-A139063; FTD-ID(RS)T-1863-83) Avail: NTIS HC A02/MF A01 CSCL 20/13

By using methane gas as the injecting media, the effect of the chemical combustion reaction on the heat transfer at the stagnation point of the laminar-flow boundary layer associated with a blunt rotating object was examined. The boundary layer is assumed to be in a state of thermodynamic equilibrium. Some calculations are also conducted by treating the methane gas as an inert gas so that the effect of the heat release associated with the chemical combustion reaction is examined by cross comparison. Author

N84-22919# Air Force Weapons Lab., Kirtland AFB, N. Mex.
DISCRETE CHARGE DIAGNOSTICS ON PRE-DIRECT COURSE Final Technical Report, Jan. - Dec. 1982
R. L. Guice and C. Bryant Feb. 1984 40 p
(WDN-S; H42-BAXY)
(AD-A139073; AFWL-TR-83-51) Avail: NTIS HC A03/MF A01 CSCL 19/4

The Air Force Weapons Laboratory attempted to make 100 time-of-arrival measurements on Pre-DIRECT COURSE. With an 88 percent success rate, the detonation wave propagation within the charge was measured. The top and bottom hemispheres detonated at two different rates. However, the detonation velocities were well within the existing data base for Ammonium-Nitrate Fuel Oil charges. One large jet was observed on the charge but its location should not have caused any problems for ground level measurements. Twenty experimental time-of-arrival crystals were also fielded; however, the results are skeptical due to the grounding system of the support structure. Author (GRA)

N84-22920# Southampton Univ. (England).
HEAT/MASS FLOW ENHANCEMENT DESIGN FOR A METAL HYDRIDE ASSEMBLY, PHASE 2 Final Report
T. A. Argabright Sep. 1983 75 p refs Prepared in cooperation with Solar Turbines, Inc., San Diego, Calif.
(Contract DE-AC02-76CH-00016)
(DE84-007182; BNL-51727) Avail: NTIS HC A04/MF A01

The development and demonstration of a metal hydride/chemical heat pump (MHHP) is reported. In the design of the MHHP, heat transfer was considered to be the key technical study area. Therefore, the goal of this effort is improved heat transfer and reduced thermal mass in a hydride heat exchanger/containment assembly. Phase II consisted of the experimental verification of the hydride alloy design data, fabrication of the hydride heat exchanger module components, heat transfer testing of a single heat exchanger element and preliminary performance testing of the entire module. In Phase II, two hydride heat exchanger modules were constructed. Each module consistes of 14 finned copper tubes in a staggered tube bundle arrangement enclosed in a cylindrical pressure vessel. The hydride powder is stored in the annular spacing between the fins. The heat transfer media, water, flows through the finned tubes. Insulation thermally isolates the tubes and hydride materials from the high mass pressure vessel. A single metallic filter in each vessel prevents hydride migrating from one vessel to another DOE

N84-22921# Centre National de la Recherche Scientifique, Orleans (France). Centre de Recherches sur la Chimie de la Combustion et des Hautes Temperatures.
THE ONSET OF DETONATION BEHIND INCIDENT SHOCK WAVES IN CHLORINE AZIDE-ARGON MIXTURES
C. Paillard, G. Dupre, and N. A. Fomin (Academy of Sciences, Minsk, USSR) 1983 21 p refs Presented at 8th Symp. Intern.

sur le Processus de Combust., Jablonna, Polond, 1983
Avail: NTIS HC A02/MF A01

Thermal stability conditions of chlorine-azide N3Cl diluted by argon were investigated. Pyrolysis was studied by the shock tube method. The reaction was monitored by emission techniques and shock velocities were measured from signals obtained with pressure microgages mounted flush with the inside wall. The critical temperature of decomposition behind the incident shock wave is not very dependent on mixture composition and pressure. Pyrolysis is complicated by a self-photolysis phenomenon initiated by species emitting from the heated gas downstream from the shock front through the unshocked gas. The effects of reaction exothermicity and shock strength on the wave velocities were investigated for different N3Cl + Ar mixtures. Above a minimum shock strength, coupling results between the reaction zone and the shock wave, from which the critical conditions for the onset of a detonation wave can be determined. Author (ESA)

N84-22922# Institute of Oceanographic Sciences, Taunton (England).
SURFACE WAVE PROPAGATION OVER SINUSOIDALLY VARYING TOPOGRAPHY: THEORY AND OBSERVATION
A. G. Davies and A. D. Heathershaw 1983 90 p refs 2 Vol.
(IOS-159-Pt-1) Avail: NTIS HC A05/MF A01

Linear perturbation theory is used to show that the reflection coefficient of a patch of sinusoidal ripples on an otherwise flat bed is oscillatory in the quotient of the length of the patch and the surface wave length, and strongly dependent upon the quotient of the surface and bed wave numbers. Resonant interaction between the surface waves and the ripples if the surface wavenumber is half the ripple wavenumber is demonstrated. Few ripples, of relatively small steepness, are required to produce a substantial reflected wave. In resonant cases, the partially standing wave on the up-wave side of the ripple patch gives way, in an almost linear manner over the the ripple patch itself, to a progressive (transmitted) wave on the down-wave side. Wave tank data agree well with predictions, and suggest coupling between wave reflection and ripple growth on an erodible bed. Author (ESA)

N84-22923# Institute of Oceanographic Sciences, Taunton (England).
SURFACE WAVE PROPAGATION OVER SINUSOIDALLY VARYING TOPOGRAPHY: THEORY AND OBSERVATION
A. G. Davies and A. D. Heathershaw 1983 95 p 2 Vol.
(IOS-159-Pt-2) Avail: NTIS HC A05/MF A01

The idealized, two-dimensional situation in which long-crested surface waves are incident upon a patch of long-crested regular bottom ripples was studied. The figures, data tables, and appendices associated with part 1 of the report are given. M.G.

N84-22924# National Engineering Lab., East Kilbride (Scotland). Fluids Div. and Flow Measurement Business Centres.
FLOW MEASUREMENT FACILITIES AT NEL ON 1 AUGUST 1983
Oct. 1983 38 p refs
(NEL-686) Avail: NTIS HC A03/MF A01

Flow measurement rigs using water, oil, air, special fluids and two-phase mixtures are described. Services available for consultancy, on-site measurement, model investigation and allied fields are covered. Author (ESA)

N84-22925# Bonn Univ. (West Germany). Sonderforschungsbereich 72.
SOLUTIONS OF THE NAVIER-STOKES EQUATIONS FOR STATIONARY FLOW IN A SPHERICAL GAP [LOESUNGEN DER NAVIER-STOKES GLEICHUNGEN FUER STATIONAERE STROEMUNGEN IM KUGLSPALT]
Geza Schrauf Jul. 1983 122 p refs In GERMAN Sponsored by Deutsche Forschungsgemeinschaft
(Preprint-611) Avail: NTIS HC A06/MF A01

The Navier-Stokes equations were solved for stationary flow in a gap between two concentric spheres the inner of which rotates and the outer of which is at rest. Rotational and equatorial symmetric solutions for several radii ratios are calculated. Stationary and unsteady solutions which depend on the Reynolds number and the radii ratio are established. The method of Bartels and Krause, which considers the time dependence of the problem, makes it possible to obtain periodic and aperiodic solutions, but does not determine which solution is established. Author (ESA)

N84-22926# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Mathematics.
LOEB SOLUTIONS OF THE BOLTZMANN EQUATION
Leif Arkeryd 1983 18 p refs Submitted for publication
(CTH-Math-1983-82; ISSN-0347-2809) Avail: NTIS HC A02/MF A01

Existence problems for the Boltzmann equation in the spatially periodic case with L sup 1 initial data are considered. Loeb subsolutions are shown to be true solutions. The proof relies on the observation that monotone entropy and finite energy imply Loeb integrability of nonstandard approximate solutions, and uses estimates from the proof of the H-theorem. Two continuity properties of the solutions are also considered. Author (ESA)

N84-22927 Oklahoma State Univ., Stillwater.
TRANSIENT THREE-DIMENSIONAL PREDICTIONS OF TURBULENT FLOWS IN CYLINDRICAL AND CARTESIAN COORDINATE SYSTEMS Ph.D. Thesis
Ahmed Ali Busnaina 1983 190 p
Avail: Univ. Microfilms Order No. DA8402603

A primitive, pressure-velocity variable, finite difference code was developed to predict turbulent three dimensional transient flows in cylindrical and cartesian coordinates. Three applications of the code are considered: local destratification near the release structure of a reservoir, deflection of a jet entering normally into a uniform crossflow, and dilution jets in gas turbine combustors. The prediction procedure is based on the transient two dimensional SOLA technique (for laminar flows), which is a finite difference scheme based on the Marker and Cell Methods. The procedure incorporates displaced grids for the three velocity components, which are placed between the nodes where pressure and other variables are stored. The pressure is deduced from the continuity equation and the latest velocity field, using a pressure-velocity iteration procedure. The developed three dimensional turbulent computer code is shown to be a simplified yet effective prediction procedure for use by persons with little or no experience in computational fluid dynamics. Dissert. Abstr.

N84-22633# Spectron Development Labs., Inc., Costa Mesa, Calif.
TEMPERATURE, CONCENTRATION, AND SIZE MEASUREMENTS IN TURBULENT REACTIVE FLOWS
M. Azzazy and J. Craig *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 1-16 refs (For primary document see N84-22632 13-20)
(Contract DE-AC22-80PC-30300; Grant NSF DMR-82-60638)
Avail: NTIS HC A99/MF A01 CSCL 20/4

N84-22637# Stanford Univ., Calif. High Temperature Gasdynamics Lab.
ADVANCED DIAGNOSTICS FOR REACTING FLOWS
R. K. Hanson, G. Kychakoff, E. C. Rea, Jr., R. D. Howe, and M. A. Kimball-Linne *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 43-50 refs (For primary document see N84-22632 13-20)
(Contract F49620-83-K-0004)
Avail: NTIS HC A99/MF A01 CSCL 20/4

N84-22644# Princeton Combustion Research Labs., Inc., N.J.
FLUID-DYNAMICALLY COUPLED SOLID PROPELLANT COMBUSTION INSTABILITY - COLD FLOW SIMULATION
Moshe Ben-Reuven *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 125-142 refs (For primary document see N84-22632 13-20)
(Contract F49620-81-C-0018)
Avail: NTIS HC A99/MF A01 CSCL 20/4

N84-22663# Gough (Paul) Associates, Inc., Portsmouth, N.H.
MULTI-DIMENSIONAL, MULTIPHASE FLOW ANALYSIS OF FLAMESPREADING IN A STICK PROPELLANT CHARGE
A. W. Horst (Ballistic Research Lab.), F. W. Robbins (Ballistic Research Lab.), and P. S. Gough *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 365-376 refs (For primary document see N84-22632 13-20)
Avail: NTIS HC A99/MF A01 CSCL 20/4

N84-22672# Ballistic Research Labs., Aberdeen Proving Ground, Md.
CONVECTIVE HEATING OF ENERGETIC MATERIALS
Richard A. Beyer and Mark A. DeWilde *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 493-498 refs (For primary document see N84-22632 13-20)
Avail: NTIS HC A99/MF A01 CSCL 20/4

N84-22690# Naval Weapons Center, China Lake, Calif.
DETAILED FLOW MEASUREMENTS IN FUEL-RICH, PARTICLE-LADEN PLUMES
M. J. Lee, K. C. Schadow, P. T. Harsha, and R. B. Edelman *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 669-684 refs Prepared in cooperation with Science Applications, Inc., Chatsworth, Calif. (For primary document see N84-22632 13-20)
Avail: NTIS HC A99/MF A01 CSCL 20/4

N84-22784# Joint Publications Research Service, Arlington, Va.
SEPARATION FLOW PAST BODIES WITH FIXED SEPARATION SITES Abstract Only
O. M. Belotserkovskiy, S. M. Belotserkovskiy, Yu. M. Davydov, and M. I. Nisht *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 10 Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), no. 4, Dec. 1983 p 821-825 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

N84-22785# Joint Publications Research Service, Arlington, Va.
DISCHARGE OF IDEAL GAS INTO VACUUM Abstract Only
S. P. Bautin and S. L. Deryabin *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 10-11 Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 273, no. 4, Dec. 1983 p 817-820 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources.* For related information see also *06 Aircraft Instrumentation,* and *19 Spacecraft Instrumentation.*

N84-22928* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
TWO-DIMENSIONAL SCANNER APPARATUS Patent
George W. Kurtz and Ben F. Bankston, inventors (to NASA) Issued 6 Mar. 1984 6 p Filed 19 Feb. 1982
(NASA-Case-MFS-25687-1; US-Patent-4,434,659;
US-Patent-Appl-SN-350474; US-Patent-Class-73-620;
US-Patent-Class-73-633; US-Patent-Class-324-262;
US-Patent-Class-74-58) Avail: UC Patent and Trademark Office CSCL 14B

An X-Y scanner utilizes an eddy current or ultrasonic current test probe to detect surface defects in small flat plates and the like. The apparatus includes a scanner which travels on a pair of slide tubes in the X-direction. The scanner, carried on a carriage which slides in the Y-direction, is driven by a helix shaft with a closed-loop helix groove in which a follower pin carried by scanner rides. The carriage is moved incrementally in the Y-direction upon the completion of travel of the scanner back and forth in the X-direction by means of an indexing actuator and an indexing gear. The actuator is in the form of a ratchet which engages ratchet gear upon return of the scanner to the indexing position. The indexing gear is rotated a predetermined increment along a crack gear to move carriage incrementally in the Y-direction. Thus, simplified highly responsive mechanical motion may be had in a small lightweight portable unit for accurate scanning of small area. Official Gazette of the U.S. Patent and Trademark Office

N84-22929* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
METHOD OF AND APPARATUS FOR DOUBLE-EXPOSURE HOLOGRAPHIC INTERFEROMETRY Patent
William K. Witherow, inventor (to NASA) Issued 31 Jan. 1984 6 p Filed 27 Jun. 1981
(NASA-Case-MFS-25405-1; US-Patent-4,428,675;
US-Patent-Appl-SN-274708; US-Patent-Class-356-347) Avail: US Patent and Trademark Office CSCL 14E

Double-exposure holographic interferometry is carried out using first and second lasers responsive to respective applied firing signals for producing respective pulsed output beams. An optical system is provided oriented such that the output beams of the lasers produce coinciding scene and reference beams. An initiator circuit generates and applies a firing signal to the first laser; and a timer/firing device responsive to the generation of a firing signal by the initiator circuit, generates and applies a firing signal to the second laser a predetermined period of time later.
Official Gazette of the U.S. Patent and Trademark Office

N84-22930* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MULTICOLOR PRINTING PLATE JOINING Patent
William J. Waters, inventor (to NASA) Issued 20 Mar. 1984 6 p Filed 28 Sep. 1982
(NASA-Case-LEW-13598-1; US-Patent-4,437,923;
US-Patent-Appl-SN-425203; US-Patent-Class-156-630;
US-Patent-Class-101-395; US-Patent-Class-156-654;
US-Patent-Class-156-905; US-Patent-Class-228-165) Avail: US Patent and Trademark Office CSCL 14E

An upper plate having ink flow channels and a lower plate having a multicolored pattern are joined. The joining is accomplished without clogging any ink flow paths. A pattern having different colored parts and apertures is formed in a lower plate. Ink flow channels each having respective ink input ports are formed in an upper plate. The ink flow channels are coated with solder mask and the bottom of the upper plate is then coated with solder. The upper and lower plates are pressed together at from 2 to 5 psi and heated to a temperature of from 295 F to 750 F or enough to melt the solder. After the plates have cooled and the pressure is released, the solder mask is removed from the interior passageways by means of a liquid solvent.
Official Gazette of the U.S. Patent and Trademark Office

N84-22931* National Aeronautics and Space Administration. Pasadena Office, Calif.
METHOD AND APPARATUS FOR PRECISION CONTROL OF RADIOMETER Patent
Roger S. Estey (California Inst. of Tech., Pasadena) and Michael F. Hanna, inventors (to NASA) (California Inst. of Tech., Pasadena) Issued 14 Feb. 1984 8 p Filed 30 Apr. 1981 Sponsored by NASA
(NASA-Case-NPO-15398-1; US-Patent-4,431,306;
US-Patent-Appl-SN-259212; US-Patent-Class-356-216;
US-Patent-Class-356-234) Avail: US Patent and Trademark Office CSCL 14B

A radiometer controller of a radiation detector is provided with a calibration method and apparatus comprised of mounting all temperature sensitive elements of the controller in thermostatically controlled ovens during calibration and measurements, using a selected temperature that is above any which might be reached

in the field. The instrument is calibrated in situ by adjusting heater power (EI) to the receptor cavity in the radiometer detector to a predetermined full scale level and is displayed by a meter.
Official Gazette of the U.S. Patent and Trademark Office

N84-22932* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ULTRASONIC TRANSDUCER WITH GAUSSIAN RADIAL PRESSURE DISTRIBUTION Patent
Richard O. Claus (Virginia Polytechnic Inst. and State Univ.) and Paul S. Zerwekh, inventors (to NASA) (Virginia Polytechnic Inst. and State Univ.) Issued 1 May 1984 6 p Filed 2 Sep. 1982 Sponsored by NASA
(NASA-Case-LAR-12967-1; US-Patent-4,446,396; US-Patent-Appl-SN-414107; US-Patent-Class-310-334; US-Patent-Class-310-317; US-Patent-Class-310-366) Avail: US Patent and Trademark Office CSCL 14B

An ultrasonic transducer that produces an output that is a symmetrical function comprises a piezoelectric crystal with several concentric ring electrodes on one side of the crystal. A resistor network applies different amplitudes of an ac source to each of the several electrodes. A plot of the different amplitudes from the outermost electrode to the innermost electrode is the first half of a Gaussian function. Consequently, the output of the crystal from the side opposite the electrodes has a Gaussian profile.
Official Gazette of the U.S. Patent and Trademark Office

N84-22933* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ACOUSTIC GROUND IMPEDANCE METER Patent
Allan J. Zuckerwar, inventor (to NASA) Issued 1 May 1984 9 p Filed 24 Nov. 1982
(NASA-Case-LAR-12995-1; US-Patent-4,445,378; US-Patent-Appl-SN-444150; US-Patent-Class-73-589; US-Patent-Class-73-594; US-Patent-Class-367-189; US-Patent-Class-181-121) Avail: US Patent and Trademark Office CSCL 14B

A method and apparatus are presented for measuring the acoustic impedance of a surface in which the surface is used to enclose one end of the chamber of a Helmholz resonator. Acoustic waves are generated in the neck of the resonator by a piston driven by a variable speed motor through a cam assembly. The acoustic waves are measured in the chamber and the frequency of the generated acoustic waves is measured by an optical device. These measurements are used to compute the compliance and conductance of the chamber and surface combined. The same procedure is followed with a calibration plate having infinite acoustic impedance enclosing the chamber of the resonator to compute the compliance and conductance of the chamber alone. Then by subtracting, the compliance and conductance for the surface is obtained. Official Gazette of the U.S. Patent and Trademark Office

N84-22934* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ELECTRONIC SCANNING PRESSURE MEASURING SYSTEM AND TRANSDUCER PACKAGE Patent
Charles F. Coe, inventor (to NASA) and Gilbert T. Parra Issued 17 Apr. 1984 14 p Filed 30 Apr. 1982
(NASA-Case-ARC-11361-1; US-Patent-4,442,716; US-Patent-Appl-SN-373771; US-Patent-Class-73-756; US-Patent-Class-73-147; US-Patent-Class-73-721; US-Patent-Class-340-870.13) Avail: US Patent and Trademark Office CSCL 14B

An electronic scanning pressure system that includes a plurality of pressure transducers is examined. A means obtains an electrical signal indicative of a pressure measurement from each of the plurality of pressure transducers. A multiplexing means is connected for selectivity supplying inputs from the plurality of pressure transducers to the signal obtaining means. A data bus connects the plurality of pressure transducers to the multiplexing means. A latch circuit is connected to supply control inputs to the multiplexing means. An address bus is connected to supply an address signal of a selected one of the plurality of pressure transducers to the latch circuit. In operation, each of the pressure transducers is successively scanned by the multiplexing means in response to address signals supplied on the address bus to the latch circuit.
Official Gazette of the U.S. Patent and Trademark Office

N84-22935*# National Aeronautics and Space Administration. Pasadena Office, Calif.
INSTRUMENTATION FOR SENSING MOISTURE CONTENT OF MATERIAL USING A TRANSIENT THERMAL PULSE Patent Application
Lien C. Yang, inventor (to NASA) (JPL, California Inst. of Tech., Pasadena) Filed 22 Dec. 1983 14 p
(Contract NAS7-100)
(NASA-Case-NPO-15494-2; US-Patent-Appl-SN-563890) Avail: NTIS HC A02/MF A01 CSCL 14B

Instrumentation for sensing moisture content of material is described which uses a transient thermal pulse. It is comprised of a sensing probe having a sensing element in the form of a ribbon excited by a constant current pulse from a source to increase the temperature, and therefore the resistance, of the ribbon linearly. Moisture in web material limits the increase of temperature during the pulse in proportion to the moisture content. This increase in temperature produces a proportional increase in resistivity which is measured with a Wheatstone bridge as a change in voltage displayed by a measurement display unit. The probe is glued in a shallow groove of a Lucite bar and connected to copper pins embedded in the bar. A cylindrical Lucite block may be used to hold the sensing element connected to axial pins in order for the probe to roll and thus reduce its wear. NASA

N84-22936# Office of Naval Research, London (England).
FAST ELECTRICAL AND OPTICAL DIAGNOSTIC PRINCIPLES AND TECHNIQUES: A NATO ADVANCED STUDY INSTITUTE
M. F. Rose 21 Nov. 1983 24 p Presented at Castlevecchio Pascoli, Italy, 10 - 24 Jul. 1983
(AD-A138598; ONRL-C-18-83) Avail: NTIS HC A02/MF A01 CSCL 14/2

The institute was divided into the following major sections: (1) overview of applications and needs, (2) voltage and current measurements, (3) data acquisition, (4) grounding and shielding, (5) fast photography, (6) refractive index measurements, (7) X-ray diagnostics, (8) spectroscopy, and (9) active optical techniques. The report examines these topics and provides tables comparing various nanosecond instrumentation techniques. Author (GRA)

N84-22937# Naval Research Lab., Washington, D. C.
A NOVEL X-RAY BACKLIGHTING METHOD FOR RAYLEIGH-TAYLOR INSTABILITY MEASUREMENTS ON ABLATIVELY DRIVEN TARGETS
J. Grun and S. Kacenjar 17 Feb. 1984 17 p
(AD-A138644; NRL-MR-5237; DE84-007762) Avail: NTIS HC A02/MF A01 CSCL 14/2

This document describes a face-on-X-ray backlighting method that does not require a dedicated laser beam and a separate X-ray source. This method is used to measure the lateral mass transfer characteristic of the Rayleigh-Taylor instability in ablatively accelerated, laser driven targets. Author (GRA)

N84-22938# South Dakota School of Mines and Technology, Rapid City. Dept. of Physics.
CHARACTERIZATION OF HUMIDITY SENSORS AND PHYSICAL PROPERTIES OF H20 Final Report, Jan. 1982 - Aug. 1983
T. Ashworth 1 Mar. 1984 46 p
(Contracts N00014-75-C-0214; N00014-82-K-0177)
(AD-A139024; AD-E401136; PHYS-84-1) Avail: NTIS HC A03/MF A01 CSCL 04/2

Commercially available humidity sensors have been evaluated. There do not appear to have been any significant advances in aluminum oxide devices recently. A new sensor (Thunder Scientific BR-101B) is a little faster than the aluminum oxide types (but not as fast as the manufacturer claims), and it has the significant advantage of a near purely resistive impedance. A monitoring system capable of following fast changes (milliseconds)

in sensor parameters has been developed; it detects and records in logarithmic fashion both the magnitude and phase of th sensor's response to a sinusoidal signal. Thermal conductivity of pure ice (Ih) and tetrahydrofuran hydrate has been measured in the temperature range 45 to 200K. The data on the pure ice is in good agreement with previous results. Our data on the clathrate hydrate is a little higher than previous measurements by a radial flow method, but we also find the conductivity to be a factor of 5 (at 200K) to 20 (at 45K) lower than that of pure ice. We find an identical temperature dependence to that found previously, and we extended measurements down to 45K. Author (GRA)

N84-22939# Oak Ridge National Lab., Tenn.
HIGH RESOLUTION ULTRASONIC DENSITOMETER
W. B. Dress 1983 9 p refs Presented at the IEEE Ultrasonics Symp., Atlanta, 2 Nov. 1983
(Contract W-7405-eng-26)
(DE84-003387; CONF-8311137-1) Avail: NTIS HC A02/MF A01

The velocity of torsional stress pulses in an ultrasonic waveguide of non-circular cross section is affected by the temperature and density of the surrounding medium. Measurement of the transit times of acoustic echoes from the ends of a sensor section are interpreted as level, density, and temperature of the fluid environment surrounding that section. This paper examines methods of making these measurements to obtain high resolution, temperature-corrected absolute and relative density and level determinations of the fluid. Possible applications include on-line process monitoring, a hand-held density probe for battery charge state indiction, and precise inventory control for such diverse fluids as uranium salt solutions in accountability storage and gasoline in service station storage tanks. DOE

N84-22940# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho. Materials Science Div.
DEVELOPMENT OF HOLOGRAPHIC INTERFEROMETRY FOR WELDING ARC ANALYSIS
J. F. Key, M. E. McIlwain, J. W. Chan, L. D. Reynolds, and J. D. Trolinger (Spectron Development Labs., Inc.) 1983 6 p refs Presented at the Intern. Congr. on Appl. of Lasers and Electro-Optics, Los Angeles, 14 Nov. 1983
(Contract DE-AC07-76ID-01570)
(DE84-005454; EGG-M-22783; CONF-831195-6) Avail: NTIS HC A02/MF A01

Automation of arc welding requires a scientific understanding of the transport phenomena occurring during the jointing process. To monitor these arc transport processes a unique holographic interferometric technique has been developed. This technique employs multi-pass reconstruction of the flow field coupled with novel schemes for reference hologram preparation. This technique has been successfully used under laboratory welding conditions. The results of these preliminary measurements are discussed. DOE

N84-22941# Fom-Instituut voor Plasmafysica, Jutphaas (Netherlands).
AN ABSOLUTE CALIBRATION METHOD FOR ELECTRON CYCLOTRON EMISSION SPECTROMETERS
B. J. D. Tubbing Nov. 1983 13 p refs Sponsored by Euratom and Nederlandse Organisatie voor Zuiver-Wetenschappelijk Onderzoek (ZWO)
(Rept-83-149) Avail: NTIS HC A02/MF A01

For absolute calibration of electron cyclotron emission spectrometers, it is shown that a large area black body can be simulated by a two dimensional scan of a microwave source. An equivalent temperature for the simulated blackbody is introduced. An expression for the calibration factor of the system, defined as the detector ouptut voltage divided by the black body temperature is derived. The frequency resolution of the spectrometer can be included in the calibration by using a swept source. Author (ESA)

N84-22942# Rolls-Royce Ltd., Derby (England).
INFRARED TEMPERATURE MEASUREMENTS IN COMBUSTION SYSTEMS
R. Lewin 10 Nov. 1982 13 p ref Presented at the Inst. of Physics' Combustion Phys. Group on Opt. Meas. of Temp. and Concentration, Denby (England), 10 Nov. 1982
(PNR-90170; Reprint-873) Avail: NTIS HC A02/MF A01

A technique for gas temperature measurement which uses the infrared radiation from and absorption of a hog molecular species is described. The system was developed for measuring fluctuating temperature in combustion systems and transient temperatures in shock or detonation tubes. The detector signal is fed to an analog computation system which calculates the temperature in real time using Planck's and Kirchoff's laws. The output from the analog computer is a voltage proportional to temperature which can be recorded onto magnetic tape. Author (ESA)

N84-22635# TRW Space Technology Labs., Redondo Beach, Calif.
THREE-COLOR PYROMETER FOR BURNING PARTICLE TEMPERATURE MEASUREMENT
N. Gat, L. M. Cohen, and A. B. Witte *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 27-34 refs (For primary document see N84-22632 13-20)
(Contract DE-AC22-81PC-40273)
Avail: NTIS HC A99/MF A01 CSCL 14/2

N84-22666# Ballistic Research Labs., Aberdeen Proving Ground, Md.
FLASH X-RAY WITH IMAGE ENHANCEMENT APPLIED TO COMBUSTION EVENTS
K. J. White and D. G. McCoy *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 415-426 refs (For primary document see N84-22632 13-20)
Avail: NTIS HC A99/MF A01 CSCL 14/2

N84-22806# Joint Publications Research Service, Arlington, Va.
APPARATUS FOR CERTIFICATION OF ANGULAR-DISPLACEMENT TRANSDUCERS Abstract Only
B. N. Ivanov *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 25 Transl. into ENGLISH from Izmeritelnaya Tekhn. (Moscow), no. 10, Oct. 1983 p 20-22 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

36 LASERS AND MASERS

Includes parametric amplifiers.

N84-22943* National Aeronautics and Space Administration. Pasadena Office, Calif.
SPECTROPHONE STABILIZED LASER WITH LINE CENTER OFFSET FREQUENCY CONTROL Patent
Michael J. Kavaya (California Inst. of Tech., Pasadena) and Robert T. Menzies, inventors (to NASA) (California Inst. of Tech., Pasadena) Issued 28 Feb. 1984 14 p Filed 31 Mar. 1982 Sponsored by NASA
(NASA-Case-NPO-15516-1; US-Patent-4,434,490; US-Patent-Appl-SN-364126; US-Patent-Class-372-20; US-Patent-Class-372-28; US-Patent-Class-372-32) Avail: US Patent and Trademark Office CSCL 20E

Continuous offset tuning of a frequency stabilized CW gas laser is achieved by using a spectrophone filled with the same gas as the laser for sensing a dither modulation, detecting a first or second derivative of the spectrophone output with a lock-in amplifier, the detected output of which is integrated, and applying the integrator output as a correction signal through a circuit which adds to the dither signal from an oscillator a dc offset that is adjusted with a potentiometer to a frequency offset from the absorption line center of the gas, but within the spectral linewidth of the gas. Tuning about that offset frequency is achieved by adding a dc value to the detected output of the dither modulation before integration using a potentiometer.

Official Gazette of the U.S. Patent and Trademark Office

N84-22944* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
METHOD AND APPARATUS FOR COATING SUBSTRATES USING A LASER Patent
Isidor Zaplatynsky, inventor (to NASA) Issued 28 Feb. 1984 5 p Filed 15 Mar. 1982
(NASA-Case-LEW-13526-1; US-Patent-4,434,189; US-Patent-Appl-Sn-358398; US-Patent-Class-427-53.1; US-Patent-Class-118-50.1; US-Patent-Class-118-624; US-Patent-Class-118-641; US-Patent-Class-427-399) Avail: US Patent and Trademark Office CSCL 20E

Metal substrates, preferably of titanium and titanium alloys, are coated by alloying or forming TiN on a substrate surface. A laser beam strikes the surface of a moving substrate in the presence of purified nitrogen gas. A small area of the substrate surface is quickly heated without melting. This heated area reacts with the nitrogen to form a solid solution. The alloying or formation of TiN occurs by diffusion of nitrogen into the titanium. Only the surface layer of the substrate is heated because of the high power density of the laser beam and short exposure time. The bulk of the substrate is not affected, and melting of the substrate is avoided because it would be detrimental.
Official Gazette of the U.S. Patent and Trademark Office

N84-22945# Army Electronics Research and Development Command, Fort Belvoir, Va. Night Vision and Electro-Optics Lab.
AN AUTOMATED SYSTEM FOR CHARACTERIZING LASER PULSES Final Report, Jan. - Jun. 1983
L. A. Atkinson and J. A. Fox Aug. 1983 38 p
(AD-A138580; DELNV-TR-0037) Avail: NTIS HC A03/MF A01 CSCL 05/1

An automated data acquisition system consisting of a Photon drag monitor, pyroelectric detector, digitizer, and computer is used to accurately and reproducibly calculate laser pulse peak intensity as well as many other important parameters including energy and pulse lengths. This system, along with a working computer program, is explained in detail. Author (GRA)

N84-22946# Stanford Univ., Calif. High Energy Physics Lab.
PROGRESS AND PROBLEMS IN STORAGE RING FREE ELECTRON LASERS Interim Report
C. Bazin, M. Bergher, M. Billardon, D. A. G. Deacon, and P. Elleaume Feb. 1983 13006 p
(Contract F49620-80-C-0068; AF Proj. 2301)
(AD-A138683; SU-HEPL-923; AFOSR-84-0101TR) Avail: NTIS HC A02/MF A01 CSCL 20/5

This document discusses current problems in storage ring laser development: optics degradation, and the low gain available on unoptimized existing electron sources. The authors introduce the field with experimental data, and conclude with the most recent results. Author (GRA)

N84-22947# Naval Research Lab., Washington, D. C.
SPECTROSCOPIC MEASUREMENTS OF THE LASER-HANE PLASMA
E. A. McLean, J. A. Stamper, H. R. Griem, A. W. Ali, and B. H. Ripin 17 Feb. 1984 34 p
(I25-BMXI)
(AD-A138685; NRL-MR-5274) Avail: NTIS HC A03/MF A01 CSCL 14/2

To simulate HANE phenomena at various altitudes, a pulsed (5 nsec) Nd-laser is focused onto Al or C foil targets surrounded by an ambient gas (N2, H2) at pressures between 15 m Torr and 5 Torr. Temperatures and densities are derived from side-on, time-resolved and time-integrated measurements of absolute spectral line and continuum intensities emitted from the photoionized region ahead of the blast-wave front, and also in the region behind the blast front. Author (GRA)

N84-22948# Defense Intelligence Agency, Washington, D.C. Directorate for Scientific and Technical Intelligence.
BIBLIOGRAPHY OF SOVIET LASER DEVELOPMENTS, NUMBER 63, JANUARY-FEBRUARY 1983
Feb. 1984 160 p
(AD-A138742; DST-2700Z-001-84) Avail: NTIS HC A08/MF A01 CSCL 20/5

This is the Soviet Laser Bibliography for January-February 1983, and is No. 63 in a continuing series on Soviet laser developments. The coverage includes basic research on solid state, liquid, gas, and chemical lasers; components; nonlinear optics; spectroscopy of laser materials; ultrashot pulse generations; crystal growing; theoretical aspects of advanced lasers; and general laser theory. Laser applications are listed under biological effects; communications; beam propagation; adaptive optics; computer technology; holography; laser-induced chemical reactions; measurement of laser parameters; laser measurement applications; laser-excited optical effects; laser spectroscopy; beam-target interaction; and plasma generation and diagnostics. Author (GRA)

N84-22949# Stanford Univ., Calif. High Energy Physics Lab.
ANOMALOUS LASER INDUCED BUNCH LENGTHENING ON THE ACO STORAGE RING FREE ELECTRON LASER Interim Report
K. E. Robinson, J. M. J. Madey, M. F. Velghe, and D. A. G. Deacon Apr. 1983 6 p Presented at the Particle Accelerator Conf., Santa Fe, N. Mex., Mar. 1983 Prepared in cooperation with Paris Univ., Orsay, France, and Deacon Research, Palo Alto, Calif.
(Contract F49620-80-C-0068; AF Proj. 2301)
(AD-A138814; HEPL-929; AFOSR-84-0103TR) Avail: NTIS HC A02/MF A01 CSCL 20/5

Laser induced bunch lengthening has been measured on the ACO Storage Ring Free Electron Laser (SRFEL) in the anomalous bunch lengthening regime. The experimental results show correlations between the appearance of coherent modes in the electron bunch and anomalous behavior in the presence of the laser. Simultaneous time resolved laser induced bunch lengthening, mode strength, bunch length, and synchrotron sideband measurements were made as anomalous thresholds were traversed several times by changing the ring laser accelerating voltage. Bunch shortening, multiple time constants, and oscillatory behavior are among the phenomena which have been observed. Author (GRA)

N84-22950# Aerospace Corp., El Segundo, Calif. Aerophysics Lab.
PULSED D2-F2 CHAIN-LASER DAMAGE TO COATED WINDOW AND MIRROR COMPONENTS
S. T. Amimoto, J. S. Whittier, A. Whittaker, A. Chase, and R. Hofland, Jr. 15 Dec. 1983 27 p
(Contract F04701-83-C-0084)
(AD-A138911; TR-0084(4930-01)-2; SD-TR-83-92) Avail: NTIS HC A03/MF A01 CSCL 20/5

Large-spot laser damage thresholds were measured for bowl-feed-polished CaF2 and sapphire windows (bare and antireflection-coated) and for highly polished copper mirrors (bare and carbyne-coated) at DF chain-laser wavelengths (3.58-4.78 micrometers). The chain reaction between F2 and D2 was initiated by a magnetically confined electron beam, producing DF-laser outputs of 10 to 20 J in pulses of 0.6 to 0.9 microseconds (FWHM) duration. Energy extracted from a transmission-coupled unstable resonator was focused by means of a CaF2 lens. A soft-aperture technique was employed to suppress effects of Fresnel diffraction so that uniform (top-hat) intensity profiles were obtained along the focusing beam. With this laser system, commercially available antireflection-coated CaF2 and Al2O3 samples were tested and found to have damage thresholds from 17 to 28 J/sq cm 2. Significantly larger damage thresholds were observed for uncoated, polished samples of Al2O3, but damage resistance of uncoated polished CaF2 was found to equal that of the best antireflection-coated CaF2 samples. A highly polished copper mirror had the highest damage threshold of all the materials tested, i.e., 58 J/sq cm 2. GRA

N84-22951# Naval Research Lab., Washington, D. C.
ABSOLUTELY UNIFORM ILLUMINATION OF LASER FUSION

PELLETS Final Report
A. J. Schmitt 17 Feb. 1984 11 p
(AD-A138944; NRL-MR-5221) Avail: NTIS HC A02/MF A01 CSCL 20/5

Absolutely uniform illumination of spherical laser fusion pellets is possible when the energy deposition from a single laser beam is given by a simple cos 3 theta distribution. Conditions can be derived for which the laser beam targeting angles allow this absolute illumination uniformity. Configurations based upon the cube and higher order Platonic solids satisfy the constraints, as well as an infinite class of other less symmetric configurations. Author (GRA)

N84-22952# Naval Research Lab., Washington, D. C.
INTRODUCTION TO THE LASER-HANE EXPERIMENT AND SUMMARY OF LOW-PRESSURE INTERACTION RESULTS
B. H. Ripin, J. Grun, S. Kacenjar, E. A. McLean, and J. A. Stamper 22 Feb. 1984 39 p
(DNA Proj. I25-BMXI)
(AD-A138945; NRL-MR-5268) Avail: NTIS HC A03/MF A01 CSCL 20/5

A brief overview of the NRL laser-target experiment which simulates the interactions involved in a HANE is presented. A burst of fast laser-produced-debris-ions stream into a low-density magnetized ambient plasma/gas. The interactions between these two plasma components are investigated under a variety of conditions. At ambient pressures below 150 mTorr we observed a magnetic bubble formation during the debris expansion; we found that the field is swept out of the volume traversed by the debris plasma and is compressed ahead of the debris front. Evidence is found for magnetic-field dependent interactions between the debris ions and ambient plasma. Author (GRA)

N84-22953# Sandia Labs., Albuquerque, N. Mex.
PLASMA-INITIATED LASER DEPOSITION OF POLYCRYSTALLINE AND MONOCRYSTALLINE SILICON FILMS
J. M. Gee, P. J. Hargis, Jr., M. J. Carr, D. R. Tallant, and R. W. Light 1983 15 p refs Presented at the Mater. Res. Soc. Ann. Meeting, Boston, 14-17 Nov. 1983
(Contract DE-AC04-76DP-00789)
(DE84-005527; SAND-83-1416C; CONF-831174-64) Avail: NTIS HC A02/MF A01

Silicon deposition using the interaction between the radiation from a pulsed ultraviolet excimer laser and the plasma species produced in a glow discharge in silicane is described. Examination of the deposited film by laser Raman spectroscopy and by transmission electron microscopy reveals that the morphology ranged from polycrystalline silicon at laser fluences of 0.13 to 0.17 J/sq cm to epitaxial silicon at fluences of 0.4 to 0.6 J/sq cm. Growth rates of 100 nm/min for polycrystalline silicon and 30 nm/min for monocrystalline silicon were achieved. DOE

N84-22954# California Univ., Livermore. Lawrence Livermore Lab.
REVIEW OF FREE ELECTRON LASER THEORY AND EXPERIMENTS
Donale Prosnitz 13 Jan. 1984 18 p refs Presented at the 5th Intern. Conf. on High Power Particle Beams, San Francisco, 12-14 Sep. 1983
(Contract W-7405-eng-48)
(DE84-007232; UCRL-89648; CONF-830911-38) Avail: NTIS HC A02/MF A01

A review of the major Free Electron Laser (FEL) experiments is presented. These experiments are designed to produce radiation at wavelengths from the far infrared to the ultraviolet. Different categories of FELS (Compton, Raman, optical klystron, two stage) as well as the suitability of various types of electron accelerators to power FELs, are discussed. Potential applications of the FEL are summarized. DOE

N84-22955# European Space Agency, Paris (France).
AIRBORNE LIDAR FOR OCEANOGRAPHY AND HYDROLOGY (FLOH)
Christian Werner and Hartmut Herrmann Jun. 1983 52 p refs Transl. into ENGLISH of "Flugzeuglidar fuer Ozeanog. U. Hydrol.' Rept. No. DFVLR-FB-82-14 DFVLR (West Germany), Oberaffenhoffen Jun. 1982
(ESA-TT-799; DFVLR-FB-82-14) Avail: NTIS HC A04/MF A01; original German version available from DFVLR, Cologne DM 18,10

An airborne lidar for determining water depth, hydrosol distribution, and temperature was designed. The suitability of Nd : YAG and dye lasers for a two laser system is analyzed. Sea bed echo, salinity, Raman scattering temperature measurement, and detectability are discussed. A development program is outlined. Author (ESA)

N84-22956# Rolls-Royce Ltd., Derby (England).
LASER DRILLING OF AERO ENGINE COMPONENTS
D. F. Toller Nov. 1982 9 p
(PNR-90185; Reprint-898) Avail: NTIS HC A02/MF A01

Cost advantages of the solid state YAG laser over other machining techniques used for production of holes in aero engine parts are discussed. While ruby and glass based systems are useful, the rapid pulse rates offered by the YAG system and the ability to use a trepanning technique for small hole drilling make it the first choice. Cost comparison with other methods show 30% to 40% savings in consummables and floor to floor times. This together with the advent of reliable CNC machines means a faster growth in applications for laser drilling than before. Author (ESA)

N84-22776# Joint Publications Research Service, Arlington, Va.
CONTROLLER FOR THE ELECTRO-OPTICAL SHUTTER OF A DUAL PULSE LASER Abstract Only
M. A. Muravitskiy and V. M. Borshciyevskiy *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 4 Transl. into ENGLISH from Pribory i Tekhn. Eksperimenta (Moscow), no. 5, Sep. - Oct. 1983 p 221 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

N84-22777# Joint Publications Research Service, Arlington, Va.
PROCEDURE FOR WALL TEMPERATURE MEASUREMENT IN A METAL VAPOR LASER Abstract Only
L. B. Direktor, A. V. Karasev, M. M. Malikov, and S. N. Skovorodko *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 4-5 transl. into ENGLISH from Pribory i Tekhn. Eksperimenta (Moscow), no. 5, Sep. - Oct. 1983 p 191-192 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

N84-22778# Joint Publications Research Service, Arlington, Va.
HOLLOW CATHODE CELL FOR PULSED LASERS USING METAL VAPORS AND THEIR CHEMICAL COMPOUNDS Abstract Only
V. Yu. Fuchko, V. A. Kelman, and I. P. Zapesochnyy *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 5-6 Transl. into ENGLISH from Pribory i Tekhn. Eksperimenta (Moscow), no. 5, Sep. - Oct. 1983 p 189-190 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

N84-22779# Joint Publications Research Service, Arlington, Va.
UTILIZING LIGHT FOCUSING BY GAS DISCHARGE MEDIUM FOR STABILIZATION OF EMISSION POWER OF He-Ne LASER AT WAVELENGTH OF 6401 ANGSTROMS Abstract Only
D. N. Gavrilov, E. M. Rabinovich, and V. V. Tuchin *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 7 Transl. into ENGLISH from Pribory i Tekhn. Eksperimenta (Moscow), no. 5, Sep. - Oct. 1983 p 187-188 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

N84-22782# Joint Publications Research Service, Arlington, Va.
MINIATURIZED PULSED CO2 LASER WITH SEALED ELECTRON SOURCE Abstract Only
Yu. I. Bychkov, V. M. Orlovskiy, V. V. Osipov, and A. G. Poteryayev

In its USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 8 Transl. into ENGLISH from Pribory i Tekhn. Eksperimenta (Moscow), no. 5, Sep. - Oct. 1983 p 185-186 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N84-22957* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
METHOD OF FABRICATING AN ABRADABLE GAS PATH SEAL Patent
Robert C. Bill and Donald W. Wisander, inventors (to NASA) Issued 7 Feb. 1984 6 p Filed 30 Sep. 1982 Division of US Patent No. 4,377,371, US Patent Appl. SN-242795, filed 11 Mar. 1981
(NASA-Case-LEW-13269-2; US-Patent-4,430,360;
US-Patent-4,377,371; US-Patent-Appl-SN-431448;
US-Patent-Appl-SN-242795; US-Patent-Class-427-34;
US-Patent-Class-415-174; US-Patent-Class-427-53.1;
US-Patent-Class-427-423; US-Patent-Class-428-155) Avail: US Patent and Trademark Office CSCL 11A

The thermal shock resistance of a ceramic layer is improved. The invention is particularly directed to an improved abradable lining that is deposited on shroud forming a gas path in turbomachinery. Improved thermal shock resistance of a shroud is effected through the deliberate introduction of benign cracks. These are microcracks which will not propagate appreciably upon exposure to the thermal shock environment in which a turbine seal must function. Laser surface fusion treatment is used to introduce these microcracks. The ceramic surface is laser scanned to form a continuous dense layer. As this layer cools and solidifies, shrinkage results in the formation of a very fine crack network. The presence of this deliberately introduced fine crack network precludes the formation of a catastrophic crack during thermal shock exposure.
Official Gazette of the U.S. Patent and Trademark Office

N84-22958* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HEAT PIPES TO REDUCE ENGINE EXHAUST EMISSIONS Patent
Donald F. Schultz, inventor (to NASA) Issued 7 Feb. 1984 8 p Filed 30 Jan. 1981
(NASA-Case-LEW-12590-1; US-Patent-4,429,537;
US-Patent-Appl-SN-229693; US-Patent-Class-60-730;
US-Patent-Class-60-736) Avail: US Patent and Trademark Office CSCL 21A

A fuel combustor is presented that consists of an elongated casing with an air inlet conduit portion at one end, and having an opposite exit end. An elongated heat pipe is mounted longitudinally in the casing and is offset from and extends alongside the combustion space. The heat pipe is in heat transmitting relationship with the air intake conduit for heating incoming air. A guide conduit structure is provided for conveying the heated air from the intake conduit into the combustion space. A fuel discharge nozzle is provided to inject fuel into the combustion space. A fuel conduit from a fuel supply source has a portion engaged in heat transfer relationship of the heat pipe for preheating the fuel. The downstream end of the heat pipe is in heat transfer relationship with the casing and is located adjacent to the downstream end of the combustion space. The offset position of the heat pipe relative to the combustion space minimizes the quenching effect of the heat pipe on the gaseous products of combustion, as well as reducing coking of the fuel on the heat pipe, thereby improving the efficiency of the combustor.
Official Gazette of the U.S. Patent and Trademark Office

N84-22959*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
IMPROVED COMPLIANT HYDRODYNAMIC FLUID JOURNAL BEARING Patent Application
Edward L. Warren, inventor (to NASA) Filed 2 Apr. 1984 11 p (NASA-Case-LEW-13670-1; US-Patent-Appl-SN-603374) Avail: NTIS HC A02/MF A01 CSCL 13I

An arc heating structure is described that prevents destructive bending moments within the top foil. Welds are eliminated by mounting the top bearing foil in the bearing cartridge sleeve without using a space block. Tabs or pins at the end of the top bearing foil are restrained by slots or stops formed in the cartridge sleeve. These structural members are free to move in a direction normal to the shaft while being restrained from movement in the direction of shaft rotation.
NASA

N84-22960*# Battelle Columbus Labs., Ohio.
MEASUREMENTS OF ELASTOHYDRODYNAMIC FILM THICKNESS, WEAR AND TEMPERING BEHAVIOR OF HIGH PRESSURE OXYGEN TURBOPUMP BEARINGS Final Report
K. F. Dufrane, T. L. Merriman, J. W. Kannel, R. D. Stockwell, D. Hauser, and J. A. Vanecho 2 Apr. 1984 45 p refs
(Contract NAS8-34908)
(NASA-CR-171008; NAS 1.26:171008) Avail: NTIS HC A03/MF A01 CSCL 13I

The reusable design of the Space Shuttle requires a target life of 7.5 hours for the turbopumps of the Space Shuttle main engine (SSME). This large increase from the few hundred seconds required in single-use rockets has caused various problems with the bearings of the turbopumps. The berings of the high pressure oxygen turbopump (HPOTP) were of particular concern because of wear, spalling, and cage failures at service time well below the required 7.5 hours. Lubrication and wear data were developed for the bearings. Since the HPOTP bearings operate in liquid oxygen, conventional liquid lubricants cannot be applied. Therefore, solid lubricant coatings and lubricant transfer from the polytetrafluoroethylene (FTFE) cage were the primary lubrication approaches for the bearings. Measurements were made using liquid nitrogen in a rolling disk machine to determine whether usable elastohydrodynamic films could be generated to assist in the bearing lubrication.

N84-22961# Dartmouth Coll., Hanover, N.H. School of Engineering.
FACTORS INFLUENCING THERMOMECHANICAL FAILURE OF FACE SEALS, 3 Annual Report, 1 Dec. 1982 - 30 Nov. 1983
F. E. Kennedy, Jr., C. K. Chuah, and W. Brote Jan. 1984 55 p
(Contract N00014-81-K-0090)
(AD-A138546; AR-3) Avail: NTIS HC A04/MF A01 CSCL 11/1

Analytical and experimental studies of factors affecting thermocracking and other modes of thermomechanical failure of mechanical face seals have continued for a third year. Mechanical face seals are assumed to operate with a uniform, thin film of sealed fluid between the flat, parallel seal faces. Recent evidence has indicated, however, that in many seals there exist patches of solid-to-solid contact between the seal faces. The temperatures and stresses near these concentrated contacts may be responsible for some modes of seal failure. In this study an experimental determination was made of the number, size and location of contact patches in actual face seals operating with and without a sealed liquid. This information was used in a numerical analysis using finite element techniques, of temperatures, deformations, and stresses around the contact patches. An independent experimental measurement of surface temperature profile within the contact patches was used to refine the numerical analysis and to enable determination of frictional heat flux and contact pressure distributions.
GRA

N84-22962# California Univ., Livermore. Lawrence Livermore Lab.
MEASUREMENT OF MELT LINE PENETRATION AND HEAT FLUX DURING ARC SPOT WELDING
C. S. Landram Oct. 1983 26 p refs Presented at the 65th

Ann. Am. Welding Soc. Conv., Dallas, 9-13 Apr. 1984
(Contract W-7405-eng-48)
(DE84-002013; UCRL-89007; CONF-840448-1) Avail: NTIS HC A03/MF A01

A new welding diagnostic technique is presented for measuring fusion boundary location (penetration), power, and power density. The method is demonstrated for stationary gas tungsten arc welding in which constant arc currents are applied to hemispherical specimens. Data obtained from the device reveal a highly unsteady fusion boundary power as a consequence of early vaporization losses and later thermal radiation losses from the top surface of the specimens. In contrast to the results for the pure metals (nickel, lead, and bismuth) tested, promotion of an enhanced penetration due to weld pool convection in the alloy (stainless steel 304) investigated was observed and attributed to its two-phase mushy zone. DOE

N84-22963# Bendix Corp., Kansas City, Mo.
WELD PENETRATION VARIATIONS Final Report
T. F. Schroeder Feb. 1984 20 p refs
(Contract DE-AC04-76DP-00613)
(DE84-007915; BDX-613-3015) Avail: NTIS HC A02/MF A01

Weld penetration problems in 304L stainless steel were analyzed by way of a literature search, weld testing, and metallographic investigation. These analyses indicated that variations in weld penetration in 304L stainless steel were a function of concentration of the minor elements of sulfur, selenium, or oxygen. Optimum range of sulfur for maximum weld penetration is 50 to 300 parts per million (ppM). DOE

N84-22964# California Univ., Livermore. Lawrence Livermore Lab.
DEVELOPMENT OF HIGH STRENGTH BRAZE JOINTS IN BERYLLIUM
P. Landon, K. W. Mahin, R. Juntz, R. Foley, and I. Stowers 18 Jan. 1984 5 p Presented at the 65th Ann. Am. Welding Soc. Conv., Dallas, 9 Apr. 1984
(Contract W-7405-eng-48)
(DE84-007243; UCRL-90294; CONF-840448-2) Avail: NTIS HC A02/MF A01

High strength, reliable aluminum brazes in beryllium could be obtained using PVD coating of aluminum on beryllium and controlling surface preparation, surface cleanliness, and coating and brazing conditions. Precision machining using a cubic boron nitride tool, rather than lapping, was selected to insure optimum surface cleanliness, while maintaining flatness and surface finish. Fully dense, adherent coatings of aluminum on beryllium were achieved by heating the substrate to 350(0)C and depositing the high purity aluminum at a rate of 120 Angstroms per sec. As-brazed joint thicknesses ranged from 0.6 to 0.9 microns (25 to 30 micro-in.). The minimum coating thickness associated with braze strengths at or above the yield of the beryllium was 0.6 microns (25 micro-in.) per surface. The tensile strengths of the braze joints under the optimum conditions were in the range of 279 to 317 MPa (40 to 46 ksi). Author

N84-22965 Tennessee Univ., Knoxville.
BIAXIAL ORIENTATION AND MECHANICAL PROPERTIES OF AMORPHOUS POLYMERS Ph.D. Thesis
Mopelola Abeke Omotoso 1983 175 p
Avail: Univ. Microfilms Order No. DA8402747

A formulation for simulating systems of deformable bodies undergoing large, nonlinear motion using vector processors is presented. For algorithms tailored to them, vector processors, such as the Cray-1 and Cyber-205, offer better computational rates than scalar processors. The equations of motion in three dimensions are derived from Cauchy's first law of motion by using the finite element method. By introducing an appropriate set of quasi-coordinates and the canonical momenta as variables, arbitrary mechanical systems are represented with a mixture of simple algebraic and first order differential equations. The general formulation is specialized and simplified by representing linearly elastic bodies as truncated series of their vibrational modes. A generalized program, named DAVES, for three dimensional problems based on the formulation for linearly elastic and rigid bodies is documented. The program is self formulating in the sense that the equations are automatically generated from a description of the bodies, joints, and applied forces in the system. Dissert. Abstr.

N84-22966 Pennsylvania State Univ., University Park.
STATE SPACE METHOD FOR OPTIMAL DESIGN OF SHOCK ABSORBERS WITH FLOATING BOUNDARIES Ph.D. Thesis
Koorosh Kasraie 1983 208 p
Avail: Univ. Microfilms Order No. DA8427511

The State Space Method for Optimal Design of Vibration Isolators given by Hsiao, Haug and Arora is used and advanced to include a more general class of problems encountered in the optimal design of shock absorbers. In contrast to the State Space Optimization, in which forcing functions, cost function and performance constraints are explicitly independent of the state variable vector at some floating boundaries, in the new formulation of the problem, forcing functions, cost function and performance constraints are a function of the state variable vector at some moving boundaries. An example of this type of problem is the design of the elastic-plastic shock absorbers for optimum performance during loading and unloading. Dissert. Abstr.

N84-22774# Joint Publications Research Service, Arlington, Va.
DYNAMIC STIFNESS OF CLOSED GAS-STATIC BEARING WITH REGULATOR Abstract Only
Yu. A. Shukholutskiy, G. Kh. Ingert, and B. G. Lurye *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 2 Transl. into ENGLISH from Mashinovedeniye (Moscow), no. 6, Nov. - Dec. 1983 p 105-109 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

N84-22775# Joint Publications Research Service, Arlington, Va.
IMPROVEMENT OF DYNAMIC CHARACTERISTICS OF GAS-STATIC BEARINGS Abstract Only
S. N. Shatokhin and V. A. Kodnyanko *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 2-3 Transl. into ENGLISH from Mashinovedeniye (Moscow), no. 6, Nov. - Dec. 1983 p 100-104 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

N84-22789# Joint Publications Research Service, Arlington, Va.
EFFECT OF HYDROMECHANICAL INERTIA FORCES ON STABILITY OF CYLINDRICAL HYDRODYNAMIC BEARING Abstract Only
K. P. Andreychenko *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 13 Transl. into ENGLISH from Mashinostr. (Moscow), no. 5, Sep. - Oct. 1983 p 96-102 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

N84-22801# Joint Publications Research Service, Arlington, Va.
PLANE MOTION OF SOLID BODY ON ROUGH SURFACE OF ANNULAR BEARING ROTATING ABOUT ITS AXIS PERPENDICULAR TO PLANE OF MOTION Abstract Only
G. Ya. Panosko *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 21-22 Transl. into ENGLISH from Mashinovedeniye (Moscow), no. 1, Jan. - FEb. 1984 p 13-15 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

N84-22802# Joint Publications Research Service, Arlington, Va.
SYSTEM FOR TORQUE CONTROL OF UNBALANCED ROTOR DURING PASSAGE THROUGH RESONANCE Abstract Only
A. S. Kelzon and L. M. Malinin *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 22 Transl. into ENGLISH from Mashinovedeniye (Moscow), no. 1, Jan. - Feb. 1984 p 16-23 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

N84-22808# Joint Publications Research Service, Arlington, Va.
BALANCING OF FLEXIBLE ROTORS WITH SIMULTANEOUS PRECISE DETERMINATION OF INFLUENCING FACTORS Abstract Only
B. V. Ryzhik and V. M. Pridman *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 27-28 Transl. into ENGLISH from Mashinovedeniye (Moscow), no. 1, Jan. - Feb. 1985 p 26-32 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N84-22967 ERA Ltd., Leatherhead (England). Materials Sciences Div.
THERMAL ENDURANCE OF SILICONE/GLASS SLEEVING BY THE CYCLIC ELECTRICAL PROOF TEST METHOD OF IEC 216 (FIRST REPORT)
Cyril P. Barry and Brian A. Heath (Suflex Ltd.) Aug. 1982 24 p refs
(ERA-82-91) Copyright. Avail: Issuing Activity

Thermal endurance tests were carried out on one grade of sleeving by the cyclic electrical proof test method, with three different electrode/test piece assemblies. The statistical calculations were carried out by the censored data procedure.
Author (ESA)

N84-22968 ERA Ltd., Leatherhead (England). Materials Sciences Div.
THERMAL ENDURANCE OF SILICONE/GLASS SLEEVING BY THE CYCLIC ELECTRICAL PROOF TEST METHOD OF ICC 216 (SECOND REPORT)
Cyril P. Barry and Brian A. Heath (Suflex Ltd.) Dec. 1982 22 p refs
(ERA-82-136) Copyright. Avail: Issuing Activity

Thermal endurance tests were carried out on one grade of sleeving by the cyclic electrical proof test method, with three different electrode/test piece assemblies. Results confirm that the shot-bath procedure (the sleeve, on a U-shaped inner wire, is covered for the proof test with metal shot to form the other electrode) gives much better data dispersion than wrapped foil procedures.
Author (ESA)

N84-22969*# Washington Univ., St. Louis, Mo. Lab. for Ultrasonics.
NON-DESTRUCTIVE EVALUATION OF COMPOSITE MATERIALS USING ULTRASOUND Semiannual Progress Report, 15 Sep. 1983 - 15 Mar. 1984
James G. Miller 15 Mar. 1984 32 p refs
(Grant NsG-1601)
(NASA-CR-173416; NAS 1.26:173416) Avail: NTIS HC A03/MF A01 CSCL 14D

Investigation of the nondestructive evaluation of advanced composite-laminates is summarized. Indices derived from the measurement of fundamental acoustic parameters are used in order to quantitatively estimate the local material properties of the laminate. The following sections describe ongoing studies of phase insensitive attenuation measurements, and discuss several phenomena which influences the previously reported technique of polar backscatter. A simple and effective programmable gate circuit designed for use in estimating attenuation from backscatter is described.
Author

N84-22970# Ohio State Univ., Columbus.
ULTRASONIC METHODS TO STUDY SHADOW BOUNDARIES OF DIFFRACTING CRACKS. ULTRASONIC CAUSTICS IN NDE (NON-DESTRUCTIVE EVALUATION) Final Report, 1 Apr. 1981 - 31 Mar. 1983
L. Adler Feb. 1984 51 p
(Contract MDA903-81-C-0290)
(AD-A138839) Avail: NTIS HC A04/MF A01 CSCL 14/2

The formation of caustics due to the defraction of ultrasound is predicted theoretically and observed experimentally in the shadow region of elliptical discontinuities in material. Good agreement is obtained between experiment and theory. It is suggested to use this method to determine size and orientation of cracks in structural materials, which is an important problem in non-destructive evaluation.
Author (GRA)

N84-22971# Rolls-Royce Ltd., Derby (England).
COST EFFECTIVENESS OF RELIABILITY IN THE AEROSPACE INDUSTRY
F. H. Thomas 1983 29 p
(PNR-90187; Reprint-900) Avail: NTIS HC A03/MF A01

A computer based reliability analysis data system was developed for jet engine assessment. The system comprises data bases for aircraft flying times and engine removals; modification embodiment at engine and module level; engine module event file with three basic formats to facilitate analysis based on sort order, and all serialized parts tracked through life and location. Problems can be placed in the context of the total exposure, giving a true measure of the risk of failure or rejection over a predetermined period of time. Failure modes on new parts are differentiated from those on worn parts, and the nature of shop related failure in a subset of the population is rapidly determined. The system is expensive to create, but its capabilities and rapidity outweigh cost disadvantages.
Author (ESA)

N84-22972# Rolls-Royce Ltd., Derby (England).
SIRE: AN INTEGRATED RELIABILITY AND COST MODEL FOR THE AEROSPACE INDUSTRY
F. H. Thomas and M. I. Littlewood 1983 17 p refs
(PNR-90192; Reprint-904) Avail: NTIS HC A02/MF A01

A Weibull based analytical model to describe the effects of design, maintenance, and operational actions in terms of changes in reliability and maintenance costs for the main aerospace propulsion plant is proposed. All reasonable behavioral subsets are recognized, e.g., inspection, rejection, replacement, repair and failure. Combination of these behavioral modes to produce overall system modes of cost and reliability at differing levels of complexity is outlined.
Author (ESA)

N84-22973# Rolls-Royce Ltd., Derby (England).
PROVEN DESIGN + NEW TECHNOLOGY = RELIABILITY + ECONOMY
R. G. Jackson 2 Nov. 1983 22 p Presented at Air Transport Assoc. of Canada Tech. Forum, 2 Nov. 1983
(PNR-90199; Reprint-917) Avail: NTIS HC A02/MF A01

Savings made available to an airline operator through incorporation of technology changes to engines which demonstrate a high level of reliability in service are discussed. These changes do not affect the fundamental integrity or design of the engine, but accept the basic design concept and introduce proven read-across type changes from other engines, to improve efficiency, reduce fuel consumption, increase engine life, and reduce maintenance. This contributes to significant reductions in the cost of ownership of an engine.
Author (ESA)

N84-23361# Air Force Logistics Command, Wright-Patterson AFB, Ohio.
QUALITY ASSURANCE - AIR FORCE LOGISTICS COMMAND Final Report
P. Brown *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 409-410 (For primary document see N84-23293 13-81)
(AD-P002816) Avail: NTIS HC A24/MF A01 CSCL 15/5

N84-23363# Defense Contract Administration Services, Cleveland, Ohio.
QUALITY AT THE CROSSROADS Final Report
C. R. Henry and J. C. Albini *In* AF Business Research Management

Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 416-418 (For primary document see N84-23293 13-81)
(AD-P002818) Avail: NTIS HC A24/MF A01 CSCL 05/1

N84-23364# Defense Logistics Agency, Alexandria, Va.
INCENTIVES FOR PRODUCT QUALITY NEED CONTRACT, COST, PRODUCTION AND FIELD CO-OPERATION Final Report
E. Theede *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 419-424 (For primary document see N84-23293 13-81)
(AD-P002819) Avail: NTIS HC A24/MF A01 CSCL 05/1

N84-23365# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
A QUALITY IMPROVEMENT STRATEGY FOR SYSTEMS ACQUISITION Final Report
G. J. Thielen *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 425-429 (For primary document see N84-23293 13-81)
(AD-P002820) Avail: NTIS HC A24/MF A01 CSCL 05/1

N84-23366# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
ENGINE PRODUCT PERFORMANCE AGREEMENTS AND THE FUTURE Final Report
J. Vertrees *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 430-434 (For primary document see N84-23293 13-81)
(AD-P002821) Avail: NTIS HC A24/MF A01 CSCL 05/1

N84-23371# Naval Electronic Systems Command, Washington, D. C.
MORTALITY AND SPAREPARTS: A CONCEPTUAL ANALYSIS Final Report
F. A. P. Frisch *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 467-480 (For primary document see N84-23293 13-81)
(AD-P002826) Avail: NTIS HC A24/MF A01 CSCL 15/5

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance.*

N84-22974 Virginia Polytechnic Inst. and State Univ., Blacksburg.
AN EVALUATION OF ALGORITHMS FOR EXTRACTING STRESS INTENSITY FACTORS FROM PHOTOELASTIC DATA FOR 3 DIMENSIONAL PROBLEMS Ph.D. Thesis
Olalekan Bolade Olaosebikan 1983 108 p
Avail: Univ. Microfilms Order No. DA8402804

Existing algorithms for extracting stress intensity factors from photoelastic data are evaluated for application to near-tip data for some three dimensional problems. The relative merits and limitations of these algorithms are thereby observed and improvements and modifications are suggested for overcoming some inherent difficulties. Finally, a new algorithm, called quadratic is introduced. Dissert. Abstr.

N84-22975*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
LARGE DEFORMATION BEHAVIOR OF LONG SHALLOW CYLINDRICAL COMPOSITE PANELS Interim Report
Douglas M. Carper, Michael W. Hyer, and Eric R. Johnson Sep. 1983 171 p refs
(Contract NCC1-15)
(NASA-CR-173286; NAS 1.26:173286; VPI-E-83-37; IR-36) Avail: NTIS HC A08/MF A01 CSCL 20K

An exact solution is presented for the large deformation response of a simply supported orthotropic cylindrical panel subjected to a uniform line load along a cylinder generator. The cross section of the cylinder is circular and deformations up to the fully snapped through position are investigated. The orthotropic axes are parallel to the generator and circumferential directions. The governing equations are derived using laminated plate theory, nonlinear strain-displacement relations, and applying variational principles. The response is investigated for the case of a panel loaded exactly at midspan and for a panel with the load offset from midspan. The mathematical formulation is one-dimensional in the circumferential coordinate. Solutions are obtained in closed-form. An experimental apparatus was designed to load the panels. Experimental results of displacement controlled tests performed on graphite-epoxy curved panels are compared with analytic predictions. Results demonstrate that panel shallowness, material orthotropy, and stacking sequence can influence the nonlinear static response. Initial geometric imperfections, observed during testing, were found to influence the response of the panels. However, the overall correlation of analytic and experimental results were good. M.G.

N84-22976# Shock and Vibration Information Center (Defense), Washington, D. C.
THE SHOCK AND VIBRATION DIGEST, VOLUME 16, NO. 3 Monthly Report
Judith Nagle-Eshleman, ed. and Loretta G. Twohig, ed. Mar. 1984 72 p refs
(AD-A139707) Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 20/11

Topics covering nonlinear transient rotor dynamics and the linear dynamics of cables are presented along with book reviews, abstracts, courses of study, and news briefs that pertain to the study of shock and vibration. Abstract categories from the current literature include structural systems, mechanical systems, vehicle systems, biodynamic response, vibration control components, and design analysis. For individual titles, see N84-22977 through N84-22978.

N84-22977# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Mechanical and Aerospace Engineering.
NONLINEAR/TRANSIENT ROTOR DYNAMICS ANALYSIS
M. L. Adams *In* the Shock and Vibration Information Center The Shock and Vibration Digest, Vol. 16, No. 3 Mar. 1984 p 3-6 refs (For primary document see N84-22976 13-39)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 20/11

A review of nonlinear transient rotor dynamics is presented with emphasis on computerized rotor vibration analysis. Gas and steam turbine engine systems are examined for unbalanced rotor vibration. Computer analysis techniques are employed to investigate rotor/stator rubbing, rotor cracking, and vibrational damping. M.A.C.

N84-22978# Massachusetts Inst. of Tech., Cambridge. Dept. of Ocean Engineering.
LINEAR DYNAMICS OF CABLES AND CHAINS
M. S. Triantafyllou *In* the Shock and Vibration Information Center The Shock and Vibration Digest, Vol. 16, No. 3 Mar. 1984 p 9-17 refs (For primary document see N84-22976 13-39)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 20/11

A review of cable dynamics is presented. A historical background is followed by sections containing literature reviews of the formulation of the problem and of linear dynamics. Effects of elasticity on the linear dynamics of an elastic cable hanging between two points at the same level are stressed. M.A.C.

N84-22979*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
PREDICTION OF FATIGUE CRACK-GROWTH PATTERNS AND LIVES IN THREE-DIMENSIONAL CRACKED BODIES
J. C. Newman, Jr. and I. S. Raju Apr. 1984 14 p refs
(NASA-TM-85787; NAS 1.15:85787) Avail: NTIS

HC A02/MF A01 CSCL 20K

Fatigue crack growth patterns and lives for surface cracks, surface cracks at holes, and corner cracks at holes in three dimensional bodies were predicted using linear-elastic fracture mechanics concepts that were modified to account for crack-closure behavior. The predictions were made by using stress intensity factor equations for these crack configurations and the fatigue crack-growth (delta K against rate) relationship for the material of interest. The crack configurations were subjected to constant-amplitude fatigue loading under either remote tension or bending loads. The predicted crack growth patterns and crack growth lives for aluminum alloys agreed well with test data from the literature.

Author

N84-22980*# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Civil Engineering.

CRACK LAYER THEORY

A. Chudnovsky Mar. 1984 43 p refs

(Grant NAG3-23)

(NASA-CR-174634; NAS 1.26:174634) Avail: NTIS HC A03/MF A01 CSCL 20K

A damage parameter is introduced in addition to conventional parameters of continuum mechanics and consider a crack surrounded by an array of microdefects within the continuum mechanics framework. A system consisting of the main crack and surrounding damage is called crack layer (CL). Crack layer propagation is an irreversible process. The general framework of the thermodynamics of irreversible processes are employed to identify the driving forces (causes) and to derive the constitutive equation of CL propagation, that is, the relationship between the rates of the crack growth and damage dissemination from one side and the conjugated thermodynamic forces from another. The proposed law of CL propagation is in good agreement with the experimental data on fatigue CL propagation in various materials. The theory also elaborates material toughness characterization.

M.A.C.

N84-22981# Oklahoma Univ., Norman. School of Aerospace and Nuclear Engineering.

NEW THEORY FOR THICK, COMPOSITE-MATERIAL RINGS

C. W. Bert Aug. 1983 28 p Presented at the 17th Israel Conf. on Mech. Engr., Tel Aviv, Israel, 12 - 14 Jul. 1983

(Contract N00014-78-C-0647)

(AD-A138538; OU-AMNE-83-4; TR-36) Avail: NTIS HC A03/MF A01 CSCL 13/13

A new theory for the in-plane elastic behavior of shear-deformable ring-type structures, i.e., curved beams and complete rings, is presented. This theory falls between Bresse-Timoshenko-type ring theory, in which the shear deformation is assumed to be distributed uniformly through the thickness and corrected by a shear correction factor determined in an ad hoc fashion, and two- or three-dimensional elasticity theory. As an example, the theory is applied to the problem of a diametrically loaded thick ring. The predicted normal-stress distribution is in excellent agreement with published results in the literature obtained by photoelastic measurements.

Author (GRA)

N84-22982# Aerospace Corp., El Segundo, Calif. Materials Sciences Lab.

CERTIFICATION VIBRATION TESTS, SD802 MATERIALS EXPERIMENT

A. F. DiGiacomo, W. C. Burns, and P. Schall 15 Dec. 1983 136 p

(Contract F04701-83-C-0084)

(AD-A138547; TR-0084(4935-05)-2; SD-TR-83-87) Avail: NTIS HC A07/MF A01 CSCL 14/2

The SD802 materials experiment has been subjected to a certification vibration test as a Space transportation system flight safety completion requirement. The test described within this report verifies the structural integrity and demonstrates the ability to satisfy functional requirements of the experiment. The final flight weight and center of gravity of each experiment tray were also determined.

GRA

N84-22983# Naval Ship Research and Development Center, Bethesda, Md. Computation Mathematics/Logistics Dept.

NASTEK: INTERACTIVE DISPLAY OF NASTRAN-GENERATED PLOTS

R. R. Lipman Jan. 1984 11 p

(F66-412)

(AD-A138831; DTNSRDC/CMLD-84/01) Avail: NTIS HC A02/MF A01 CSCL 09/2

A new postprocessor program, NASTEK, will display NASTRAN-generated plots interactively on a Tektronix 4014, 4015, or 4054 terminal. The output, written by NASTRAN on the PLT2 file, is used for input to NASTEK. The NASTEK program is more convenient to use than plotting NASTRAN plots on the off-line CALCOMP 936 plotter at the David W. Taylor Naval Ship R&D Center, since it integrates the NASTRAN/interactive plotting process. NASTEK can be run at any site with CDC computers and Tektronix terminals.

Author (GRA)

N84-22984# Minnesota Univ., Minneapolis. Dept. of Aerospace Engineering and Mechanics.

WAVE ATTENUATION IN PERIODIC STRUCTURES Interim Technical Report, Jul. 1983 - Jan. 1984

R. Plunkett and A. K. Roy 9 Feb. 1984 54 p

(Contract N00014-82-K-0591)

(AD-A138924; AEM-RP-84-1) Avail: NTIS HC A04/MF A01 CSCL 20/11

The analytical and experimental results for the attenuation of traveling bending waves in a uniform beam with tuned periodic cantilever ribs are presented. Results are given for one, three, five, seven, fifteen and an infinite number of sections.

Author (GRA)

N84-22985# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.

CORROSION AND LOAD TRANSFER EFFECTS ON FATIGUE OF MECHANICALLY FASTENED JOINTS. FATIGUE OF ZERO LOAD TRANSFER SPECIMEN

E. U. Lee 4 Oct. 1983 26 p

(ZR0-0001)

(AD-A139042; NADC-83133-60) Avail: NTIS HC A03/MF A01 CSCL 13/5

This IR program studies the effects of load transfer and corrosive environment on fatigue of mechanically fastened joints. As an initial part of the program, the fatigue crack initiation and growth, and the final fracture in zero load transfer specimens of 7475-T7351 aluminum alloy were investigated. The applied stress range was related to the fatigue crack initiation life Ni and the total fatigue Nf by empirical equations. The variation of fatigue crack growth rate with stress intensity factor range was defined. The proportion of fatigue crack initiation an growth lives was determined as a function of the stress range and the total fatigue life.

GRA

N84-22986# Army Engineer Waterways Experiment Station, Vicksburg, Miss.

CASE (COMPUTER-AIDED STRUCTURAL ENGINEERING) STUDY OF 6 MAJOR GENERAL-PURPOSE FINITE ELEMENT PROGRAMS Final Technical Report

R. L. Hall and N. Radhakrishnan Oct. 1983 82 p

(AD-A139065; WES/TR/K-83-4) Avail: NTIS HC A05/MF A01 CSCL 13/13

The programs studied were SAP, E3SAP, GTSTRUDL, MC-AUTO STRUDL, ANSYS, and SUPERB. The study involved a number of static, linear eleatic analyses. The efficiency of the six GPP's typically used in the Corps was evaluated using a cantilever beam. Costs were computed for problems having the same bandwidth (BW) but varying degrees of freedom (DoF's) as well as for problems having the same DoF's but different BW's. Two other problems representing typical Corps structures were also run using the same six GPP's. The first of these problems involved a concrete lock monolith on an elastic foundation. The second, a bulkhead, required an analysis of plate stretching and bending finite elements combined with the action of framing members.

The study also involved a comparison of some general-purpose pre- and post-processors that can be used in conjunction with the GPP's. The report is meant only to provide data on some GPP's used in the Corps. Due to the rapid changed in technology, constant improvements are made to the code. This coupled with the changes in computer cost algorithms makes it imperative for the user to verify and update the data in this report periodically. Also, since Corps' new computer contract has been awarded to CYBERNET, these studies need to be run in their system to be of maximum benefit. This will be done in a subsequent report. GRA

N84-22987# Naval Postgraduate School, Monterey, Calif.
UNDERWATER SHOCK-INDUCED RESPONSES OF SUBMERGED CYLINDRICAL STRUCTURES M.S. Thesis
F. G. Daube Dec. 1983 110 p
(AD-A139072) Avail: NTIS HC A06/MF A01 CSCL 20/4

The non-linear elasto-plastic responses of a submerged cylindrical shell to an underwater shock wave have been investigated. Using the EPSA (Elasto-Plastic Shell Analysis) code, the gross responses of homogeneous and ring-stiffened shells were evaluated. The relevant parameters have been displayed and evaluated using PATRAN-G color graphics system. An interface module was developed between EPSA and PATRAN-G. The deformations and von Mises stresses throughout the shell have been qualitatively evaluated. Author (GRA)

N84-22988# Dayton Univ., Ohio.
DEVELOPMENT OF AN IMPACT RESISTANT TEST METHOD FOR POLYCARBONATE Interim Report, Oct. 1978 - Nov. 1983
K. I. Clayton, G. J. Stenger, B. S. West, and P. E. Johnson Wright-Patterson AFB, Ohio AFWAL Feb. 1984 74 p
(Contracts F33615-76-C-3103; F33615-80-C-3401; AF Proj. 1926) (AD-A139082; UDR-TR-82-141; AFWAL-TR-83-3128) Avail: NTIS HC A04/MF A01 CSCL 14/2

Polycarbonate offers many advantages as a structural transparency material, having excellent impact resistance as well as acceptable optical and thermal properties; however, one of the difficulties in evaluating impact resistance of polycarbonate is the lack of a universally accepted and standardized test method. Some transparency vendors rely on the falling weight impact test which yields good qualitative results. However, to date these falling weight impact tests have been performed under loosely controlled conditions, not governed by well-defined test procedures. The notched Izod test has been and continues to be used for qualitatively evaluating impact resistance of polycarbonate per MIL-P-83310, even though it has not been clearly established that this is the best method for evaluating the impact resistance of notch-sensitive polycarbonate. This report discusses six test methods and compares the results from each test. Author (GRA)

N84-22989# Rochester Univ., N. Y. Dept. of Mechanical Engineering.
FRACTURE TOUGHNESS PROCESSES Final Report, 15 Feb. 1981 - 14 Feb. 1984
S. J. Burns Feb. 1984 16 p refs
(Contract DE-AC02-81ER-10856)
(DE84-007244; DOE/ER-10856/05) Avail: NTIS HC A02/MF A01

Crack tip deformation reduces the local crack stresses and shields the crack tip from the applied stress intensity factor. Crack tip shielding due to mixed edge and screw dislocations and dislocation dipole pairs, parallel to the crack front, are investigated. Crack tip deformation in LiF single crystals is observed. Blunting and jogging dislocations and dislocation pile up structures were seen. These dislocations behave differently. The crack tip shielding concept is also applied to volume and shear transformations in phase transformation toughening materials. Partially stabilized zirconia is thermally cycled while under stress for analysis in stress-induced phase transformation toughening. DOE

N84-22990# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
THE APPLICATION OF COLD WORKED HOLES (IN AIRCRAFT STRUCTURES)
A. U. deKoning Aug. 1983 33 p refs In DUTCH; ENGLISH summary
(NLR-TR-81120-U) Avail: NTIS HC A03/MF A01

Consequences of the application of cold worked holes in aluminum alloy aircraft structures were studied. The plastic expansion of holes method of introducing residual stresses is considered. A mathematical model of the process of this method is formulated and applied to series of expanded holes. Formulas for stresses and deformations near cold worked holes are derived. Author (ESA)

N84-22991 State Univ. of New York, Buffalo.
TIME OPTIMAL DIGITAL CONTROL OF MULTI-UNIT PAPER WEB DYNAMICS Ph.D. Thesis
Ta-Hsiung Wong 1983 193 p
Avail: Univ. Microfilms Order No. DA8401713

An attempt to apply the classical and modern control theories for a multi-unit paper web tension control problem is described. Particular attention is given to the problem of developing and applying the time-optimal control theory in the discrete-time domain for a paper web dynamic system. A digital control algorithm utilizing time-optimal control theory, and a compact form deadbeat controller with a generalized compact form deadbeat reduced order observer for controlling the paper web dynamics were developed. In the continuous time domain, the multivariable control technique, either the pole assignment method or the optimal linear regular method, incorporated with a reduced order observer for controlling the paper web dynamics was obtained. Several simulations of the multivariable control of the paper web dynamics show that it is not only able to design optimally a control system, but that it also employs an observer to replace the tension transducers which sometimes might cause undesirable behavior due to unexpected oscillation. Dissert. Abstr.

N84-22992 Michigan Univ., Ann Arbor.
STRENGTH OF BOLTED JOINTS IN LAMINATED COMPOSITES Ph.D. Thesis
Fu-Kuo Chang 1983 179 p
Avail: Univ. Microfilms Order No. DA8402258

A method is presented for predicting the failure strenght and failure mode of pin-loaded holes in fiber reinforced composite laminates. The method includes two steps. First, the stress distribution in the laminate is calculated by the use of finite element method. Second, the failure load and failure mode are predicted by means of a proposed failure hypothesis together with the Yamada-Sun failure criterion. A computer code was developed, which is used to calculate the maximum load and the mode of failure of joints involving laminates with different ply orientations, different material properties, and different geometries. Tests were performed measuring the rail-shear strength and the characteristic lengths for Fiberite T300/1034-C composites. Tests were also conducted measuring the failure strengths and failure modes of Fiberite T300/1034-C laminates containing a pin-loaded hole or two pin-loaded holes in parallel or in series. Dissert. Abstr.

N84-22993 Akron Univ., Ohio.
FINITE ELEMENT ANALYSIS OF STRUCTURE SUBJECTED TO NONSTATIONARY LOAD FIELDS WITH CONTACT INTERFACES Ph.D. Thesis
Opart Paramadilok 1984 263 p
Avail: Univ. Microfilms Order No. DA8403781

A traveling finite element methodology which can handle the time dependent response of moving structures which are themselves subject to time dependent traveling load fields is presented. The generality of the approach developed is to employ a variable speed moving Lagrangian observer such that it can handle the overall time dependent response due to moving loads whose magnitude, zone of contact interface, and trajectory are time dependent. The full complement of initial fields as well as viscoelastic material behavior are also considered. The results of several example problems of rolling tires are included in the

presentation. The results of the example problems are in good agreement in comparing with those obtained from the experiments. Dissert. Abstr.

N84-22994 Princeton Univ., N. J.
EFFECTS OF TRANSVERSE LOADING ON THE THICKNESS SHEAR RESONANCE FREQUENCIES IN CRYSTAL PLATES Ph.D. Thesis
Chun-Sing Lam 1984 140 p
Avail: Univ. Microfilms Order No. DA8402667

A system of six two-dimensional equations is derived for the small incremental vibrations superimposed on infinitesimal initial deformation. The terms associated with the third-order elastic constants in the stress-strain relations are retained. These equations govern the six lowest modes of crystal vibrations, namely, flexure, extension, face-shear, thickness-shear, thickness-stretch, and thickness-twist. They are employed in the study of the effects of initial bending on the thickness-shear resonance frequencies of cantilever singly- and doubly-rotated quartz plates. First, a system of one-dimensional approximate equations is derived to replace the two-dimensional Cauchy's equations for elastic, crystal plates. The equations are used for the study of the deflection and bending stresses in rectangular cantilever plates. Then, in a similar manner, Mindlin's two-dimensional first-order equations or crystal plates are replaced by an infinite system of one-dimensional equations. Solutions of initial stresses and displacement due to transverse loading are obtained analytically, which may be regarded as functions of space in the equations of motion of incremental vibrations. Dissert. Abstr.

N84-22995 Oklahoma State Univ., Stillwater.
A DISCRETE-ELEMENT ANALYSIS FOR LARGE DEFLECTION OF THIN PLATES: A COMBINED EFFECT OF GEOMETRIC AND MATERIAL NONLINEARITIES Ph.D. Thesis
Hossein Khoddam-Mohammadi 1983 159 p
Avail: Univ. Microfilms Order No. DA8402628

Scope of Study, a finite difference formulation is presented for the analysis of thin plates which includes geometric and material nonlinear behavior. Material properties are represented by a bilinear effective stress-effective strain generalization of a uniaxial tension test. Elastic and elastic-plastic materials are considered. The behavior of the plate is simulated by bending and membrane models. The bending model resists only lateral loads while the membrane model resists both in-plane and lateral loads. The solution method is stepwise linear. At each step, a part of the total load is applied to the plate structure. Two methods are employed to achieve solution. The first utilizes alternating bending and membrane solutions to satisfy equilibrium, compatibility, and flow rules. This procedure is utilized in the initial phase of the program, where the resistance of the bending model continues to increase with increase in lateral loads. A second method utilizing a composite bending and membrane model is used when the alternating bending membrane solution fails. Dissert. Abstr.

N84-22996 Massachusetts Univ., Amherst.
METHOD OF INITIAL FUNCTIONS FOR THICK SHELLS Ph.D. Thesis
Susan Faraji 1983 181 p
Avail: Univ. Microfilms Order No. DA8401059

In present work for circular cylindrical shells, three-dimensional elasticity equations are solved by assuming Taylor series expansions, in the radial direction, for the stresses and displacements. Depending upon the number of terms retained in the expansion, different order shell theories are derived, classical theories (referred to as 8th order), the shear deformaton-traverse normal stress theories (referred to as 10th order), and higher order theories (referred to as 12th order). In each case by carrying out the symbolic algebra using the digital computer, partial differential equations are derived for both static and dynamic cases. The procedure was carried out in detail for the case of a circular cylindrical shell with no loading on the interior surface and a given pressure distribution on the exterior surface. Then numerical comparisons are made between the current theories and various shell theories as well as the exact (three dimensional) theory. Dissert. Abstr.

N84-22798# Joint Publications Research Service, Arlington, Va.
STUDY OF LARGE VISCOPLASTIC STRAINS IN CYLINDRICAL SHELLS BY METHOD OF MAGNETIC-PULSE LOADING Abstract Only
V. G. Bazhenov, V. K. Lomunov, M. V. Petrov, and A. G. Ugodchikov *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 19-20 Transl. into ENGLISH from Mashinovedeniya (Moscow), no. 5, Sep. - Oct. 1983 p 73-80 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

N84-22799# Joint Publications Research Service, Arlington, Va.
ESTIMATION OF LOCAL STRESS INTENSITY IN FLANGED THIN-WALL SHELL STRUCTURES UNDER HEAVY THERMAL LOAD Abstract Only
V. N. Khoroshilov, P. I. Kotov, and A. P. Gusenkov *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 20 Transl. into ENGLISH from Mashinovedeniye (Moscow), no. 5, Sep. - Oct. 1983 p 64-72 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

N84-22800# Joint Publications Research Service, Arlington, Va.
STRESSED-STRAINED STATE OF FLANGED SHELLS UNDER HEAVY THERMAL LOAD BEYOND ELASTIC LIMIT Abstract Only
A. P. Gusenkov, P. I. Kotov, V. N. Khorotilov, and S. F. Kuznetsov *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 21 Transl. into ENGLISH from Mashinovedeniye (Moscow), no. 6, Nov. - Dec. 1983 p 56-66 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

N84-22805# Joint Publications Research Service, Arlington, Va.
SOLVING STATICS PROBLEMS OF THICK-WALLED CYLINDRICAL SHELLS WITH LOOSE CONTACT BETWEEN LAYERS Abstract Only
A. T. Vasilenko, Ya. M. Grigorenko, and N. D. Pankratova *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 24 Transl. into ENGLISH from Dokl. Akad. Nauk Ukr. SSR Ser. A: Fiz.-Mat. i Tekhn. Nauki (Kiev), no. 11, Nov. 1983 p 40-43 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

42 GEOSCIENCES (GENERAL)

No abstracts in this category.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography.*

N84-22997*# California Univ., Santa Barbara. Dept. of Geography.
LANDSAT-D INVESTIGATIONS IN SNOW HYDROLOGY Quarterly Progress Report, 1 Jan. - 31 Mar. 1984
Jeff Dozier, Principal Investigator 31 Mar. 1984 9 p refs ERTS (Contract NAS5-27463)
(E84-10094; NASA-CR-173480; NAS 1.26:173480) Avail: NTIS HC A02/MF A01 CSCL 08L

Thematic mapper radiometric characteristics, snow/cloud reflectance, and atmospheric correction are discussed with application to determining the spectral albedo of snow. The geometric characterics of TM and digital elevation data are examined. The geometric transformations and resampling required to coregister these data are discussed. For individual titles, see N84-22998 through N84-22999.

N84-22998*# California Univ., Santa Barbara. Dept. of Geography.
ATMOSPHERIC MODEL DEVELOPMENT
In its LANDSAT-D Invest. in Snow Hydrol. 31 Mar. 1984 p 1-6 refs Proposed for presentation at LARS Symp., Jun. 1984 ERTS (For primary document see N84-22997 13-43)
Avail: NTIS HC A02/MF A01 CSCL 08B

Spectral albedo measurements from the LANDSAT-4/5 thematic mappers require that spacecraft upwelling radiances be corrected for atmospheric absorption and scattering and for local surface illumination. A two-stream model is developed, with a lower boundary condition that varies with incidence angle. The TM data must be registered to digital terrain data. Reflectance from points in shadows can be used to estimate optical depth. The primary application is determination of the spectral albedo of snow. The TM is better-suited for this purpose than the MSS because of its larger dynamic range. Author

N84-22999*# California Univ., Santa Barbara. Dept. of Geography.
REGISTRATIOM OF TM DATA TO DIGITAL ELEVATION MODELS
In its LANDSAT-D Invest. in Snow Hydrol. 31 Mar. 1984 p 6-9 refs Proposed for presentation at the LARS Symp., Jun. 1984 ERTS (For primary document see N84-22997 13-43)
Avail: NTIS HC A02/MF A01 CSCL 08B

Several problems arise when attempting to register LANDSAT thematic mapper data to U.S. B Geological Survey digital elevation models (DEMs). The TM data are currently available only in a rotated variant of the Space Oblique Mercator (SOM) map projection. Geometric transforms are thus; required to access TM data in the geodetic coordinates used by the DEMs. Due to positional errors in the TM data, these transforms require some sort of external control. The spatial resolution of TM data exceeds that of the most commonly DEM data. Oversampling DEM data to TM resolution introduces systematic noise. Common terrain processing algorithms (e.g., close computation) compound this problem by acting as high-pass filters. Author

N84-23000*# Arizona Univ., Tucson. Optical Sciences Center.
SPECTRORADIOMETRIC CALIBRATION OF THE THEMATIC MAPPER AND MULTISPECTRAL SCANNER SYSTEM Quarterly Report, 1 Nov. 1983 - 1 Feb. 1984
James Palmer, Principal Investigator and Philip Slater 1 Feb. 1984 35 p refs ERTS
(Contract NAS5-27382)
(E84-10098; NASA-CR-173367; NAS 1.26:173367; QR-5) Avail: NTIS HC A03/MF A01 CSCL 08B

Results of an analysis that relates TM saturation level to ground reflectance, calendar date, latitude, and atmospheric conditions are reported. The determination of the spectral reflectance at the entrance pupil of the LANDSAT 4 pupil of the thematic mapper is described. For individual titles, see N84-23001 through N84-23002.

N84-23001*# Arizona Univ., Tucson. Optical Sciences Center.
SENSOR RADIANCE FOR A MIDLATITUDE ATMOSPHERIC MODEL
In its Spectroradiometric Calibration of the Thematic Mapper and Multispectral Scanner System 1 Feb. 1984 p 1-14 refs ERTS (For primary document see N84-23000 13-43)
Avail: NTIS HC A03/MF A01 CSCL 08B

The Herman radiative transfer code which iteratively traces solar radiance through a discrete number of scattering angles and many atmospheric layers was transferred to a personnal computer to reduce time in recompiling the source code. The code was then used to predict what ground reflectance would saturate the TM sensor output given a standard midlatitude atmospheric model. Output radiance is tabulated for the first four bands. Plots show radiance at the sensor as a function of solar zenith angle from a visibility of 40 km; solar zenith angle as a function of time of year for four latitudes over a typical portion of the descending node of a LANDSAT orbit; and values of ground reflectance required to saturate the TM sensor from three different aerosol loading conditions (corresponding to about 20 km, 40 km. and greater than 100 km visibility). A.R.H.

N84-23002*# Arizona Univ., Tucson. Optical Sciences Center.
IN-FLIGHT ABSOLUTE RADIOMETRIC CALIBRATION OF THE THEMATIC MAPPER
James Palmer, Phillip N. Slater, Principal Investigators, K. R. Castle, R. G. Holm, C. J. Kastner, M. Dinguirard (Centre d'Etudes et de Recherces de Toulouse, France), C. E. Ezra (Agriculture Dept., Phoenix, Ariz.), R. D. Jackson (Agriculture Dept., Phoenix, Ariz.), and R. K. Savage (Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.) *In its* Spectroradiometric Calibration of the Thematic Mapper and Multispectral Scanner System 1 Feb. 1984 p 15-34 refs Submitted for publication ERTS (For primary document see N84-23000 13-43)
Avail: NTIS HC A03/MF A01 CSCL 08B

Ground spectral reflectance and atmospheric spectral optical depth measurements made at White Sands, New Mexico were used with an atmospheric radiative transfer program to determine the spectral radiance at the entrance pupil of the LANDSAT-4 TM. Comparison with the output digital counts of the TM, when imaging the measured ground area, provided an absolute calibration for five detectors in TM bands 2, 3, and 4. By reference to an adjacent, larger uniform area, the calibration was extended to all 16 detectors in each of three bands. Preflight calibration results agreed with these inflight measurements to 6.6%, 2.4%, and 12.9% in bands 2,3, and 4, respectively. Author

N84-23003*# EROS Data Center, Sioux Falls, S. Dak.
LANDSAT 4 INVESTIGATIONS OF THEMATIC MAPPER AND MULTISPECTRAL SCANNER APPLICATIONS Quarterly Report
Donald T. Lauer, Principal Investigator 26 Apr. 1984 19 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(NASA Order S-10757-C)
(E84-10100; NASA-CR-173369; NAS 1.26:173369) Avail: NTIS HC A02/MF A01 CSCL 08B

The optimum index factor package was used to choose TM band for color compositing. Processing techniques were also used on TM data over several sites to: (1) reduce the amount of data that needs to be processed and analyzed by using statistical methods or by combining full-resolution products with spatially compressed products; (2) digitally process small subareas to improve the visual appearance of large-scale products or to merge different-resolution image data; and (3) evaluate and compare the information content of the different three-band combinations that can be made using the TM data. Results indicate that for some applications the added spectral information over MSS is even more important than the TM's increased spatial resolution. A.R.H.

N84-23004*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE PENNSYLVANIA DEFOLIATION APPLICATION PILOT TEST
R. G. McLeod, A. L. Zobrist, and N. A. Bryant 15 Sep. 1983 174 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(Contract NAS7-100)
(E84-10111; NASA-CR-173481; JPL-Pub-83-65; NAS 1.26:173481) Avail: NTIS HC A08/MF A01 CSCL 02F

Satellite imagery for the State of Pennsylvania was digitally mosaicked to provide the seed data base for monitoring defoliation

of hardwood trees by the gypsy moth. Two separate mosaics for the state were prepared, one before defoliation and one after defoliation, to determine the extent, direction, and impact of gypsy moth activity in the state. The digital mosaic technology used to construct the data base was transferred to Pennsylvania State University to permit periodic updates to the data base and to assist in planning and abatement activities. Participating agencies or institutions included Goddard Space Flight Center and the Pennsylvania State University Office for Remote Sensing of Earth Resources. Author

N84-23005*# Iowa Univ., Iowa City. Dept. of Geology.
USE OF MAGSAT ANOMALY DATA FOR CRUSTAL STRUCTURE AND MINERAL RESOURCES IN THE US MIDCONTINENT Final Project Report, Dec. 1980 - Sep. 1983
Robert S. Carmichael Oct. 1983 177 p Original contains color illustrations ERTS
(Contract NAS5-26425)
(E84-10112; NASA-CR-173482; NAS 1.26:173482) Avail: NTIS HC A09/MF A01 CSCL 08G

Magnetic field data acquired by NASA's MAGSAT satellite is used to construct a long-wavelength magnetic anomaly map for the U.S. midcontinent. This aids in interpretation of gross crustal geology (structure, lithologic composition, resource potential) of the region. Magnetic properties of minerals and rocks are investigated and assessed, to help in evaluation and modelling of crustal magnetization sources and depth to the Curie-temperature isotherm. Author

N84-23006*# Texas A&M Univ., College Station. Remote Sensing Center.
CONSERVB: A NUMERICAL METHOD TO COMPUTE SOIL WATER CONTENT AND TEMPERATURE PROFILES UNDER A BARE SURFACE Semiannual Report, Mar. - Sep. 1982
C. H. M. vanBavel and R. Lascano Sep. 1982 79 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS
(Grant NAG5-31; Proj. AgRISTARS)
(E84-10113; NASA-CR-173483; SM-T3-04448; NAS 1.26:173483; RSC-134) Avail: NTIS HC A05/MF A01 CSCL 02C

A comprehensive, yet fairly simple model of water disposition in a bare soil profile under the sequential impact of rain storms and other atmospheric influences, as they occur from hour to hour is presented. This model is intended mostly to support field studies of soil moisture dynamics by our current team, to serve as a background for the microwave measurements, and, eventually, to serve as a point of departure for soil moisture predictions for estimates based in part upon airborne measurements. The main distinction of the current model is that it accounts not only for the moisture flow in the soil-atmosphere system, but also for the energy flow and, hence, calculates system temperatures. Also, the model is of a dynamic nature, capable of supporting any required degree of resolution in time and space. Much critical testing of the sample is needed before the complexities of the hydrology of a vegetated surface can be related meaningfully to microwave observations. A.R.H.

N84-23007*# Texas A&M Univ., College Station. Remote Sensing Center.
A MICROWAVE SYSTEMS APPROACH TO MEASURING ROOT ZONE SOIL MOISTURE Semiannual Report, Sep. 1982 - Mar. 1983
R. W. Newton, J. F. Paris, and B. V. Clark Mar. 1983 69 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(Grants NsG-5266; NAG5-31; Proj. AgRISTARS)
(E84-10114; NASA-CR-173484; SM-T3-04447; NAS 1.26:173484; RSC-138) Avail: NTIS HC A04/MF A01 CSCL 02C

Computer microwave satellite simulation models were developed and the program was used to test the ability of a coarse resolution passive microwave sensor to measure soil moisture over large areas, and to evaluate the effect of heterogeneous ground covers with the resolution cell on the accuracy of the soil moisture estimate. The use of realistic scenes containing only 10% to 15% bare soil and significant vegetation made it possible to observe a 60% K decrease in brightness temperature from a 5% soil moisture to a 35% soil moisture at a 21 cm microwave wavelength, providing a 1.5 K to 2 K per percent soil moisture sensitivity to soil moisture. It was shown that resolution does not affect the basic ability to measure soil moisture with a microwave radiometer system. Experimental microwave and ground field data were acquired for developing and testing a root zone soil moisture prediction algorithm. The experimental measurements demonstrated that the depth of penetration at a 21 cm microwave wavelength is not greater than 5 cm. A.R.H.

N84-23008*# Purdue Univ., Lafayette, Ind. Dept. of Geosciences.
APPLICATION OF MAGSAT LITHOSPHERIC MODELING IN SOUTH AMERICA. PART 1: PROCESSING AND INTERPRETATION OF MAGNETIC AND GRAVITY ANOMALY DATA Final Report
William J. Hinze, Lawrence W. Braile, Ralph R. B. vonFrese, Principal Investigators, G. R. Keller, and E. G. Lidiak Jan. 1984 58 p refs Prepared in cooperation with Texas Univ., El Paso and Pittsburgh Univ. ERTS
(Contract NAS5-26287)
(E84-10115; NASA-CR-173485; NAS 1.26:173485) Avail: NTIS HC A04/MF A01 CSCL 08G

Scalar magnetic anomaly data from MAGSAT, reduced to vertical polarization and long wavelength pass filtered free air gravity anomaly data of South America and the Caribbean are compared to major crustal features. The continental shields generally are more magnetic than adjacent basins, oceans and orogenic belts. In contrast, the major aulacogens are characterized by negative anomalies. Spherical earth magnetic modeling of the Amazon River and Takatu aulacogens in northeastern South America indicates a less magnetic crust associated with the aulacogens. Spherical earth modeling of both positive gravity and negative magnetic anomalies observed over the Mississippi Embayment indicate the presence of a nonmagnetic zone of high density material within the lower crust associated with the aulacogen. The MAGSAT scalar magnetic anomaly data and available free air gravity anomalies over Euro-Africa indicate several similar relationships. M.A.C.

N84-23009*# Rochester Inst. of Tech., N. Y. Coll. of Graphic Arts and Photography.
LANDSAT 4 BAND 6 DATA EVALUATION Quarterly Report
15 Mar. 1984 3 p ERTS
(Contract NAS5-27323)
(E84-10119; NASA-CR-173489; NAS 1.26:173489; QR-6) Avail: NTIS HC A02/MF A01 CSCL 05B

Previously experienced data collection problems were successfully resolved. A limited effort, directed at improved methods of display of TM Band 6 data, has concentrated on implementation of intensity hue and saturation displays using the Band 6 data to control hue. These displays tend to give the appearance of high resolution thermal data and make whole scene thermal interpretation easier by color coding thermal data in a manner that aids visual interpretation. More quantitative efforts were directed at utilizing the reflected bands to define land cover classes and then modifying the thermal displays using long wave optical properties associated with cover type. A.R.H.

N84-23010# Academy of Sciences (USSR), Moscow. Soviet Geophysical Comm.
SCIENTIFIC ACTIVITY IN HYDROLOGY, 1979-1982
1983 26 p refs In RUSSIAN and ENGLISH Presented at the 18th Gen. Assembly of the International Union of Geodesy and Geophysics
Avail: NTIS HC A03/MF A01

Brief lists of principal publications pertaining to certain aspects of the hydrological investigations discussed in separate sections

are contained. Aspects of the theory, methodology and techniques of field and laboratory experiments are covered. The connection with the management of the formation, use and protection of water resources is a characteristic feature of these studies. As is known, the connection with practice was a characteristic feature of the scientific investigations undertaken in the USSR for a long time, however, during the years covered this tendency further developed and gained new specific features worth mentioning here. Thus, in addition to engineering problems solved in hydrological studies for grounding hydraulic structure projects, more requirements are put forward by economic and ecological aspects of water development projects, and these aspects should be incorporated into the theory and methods of water resources management. Author

N84-23011# National Academy of Sciences - National Research Council, Washington, D. C. National Materials Advisory Board.
PRIORITIES FOR DETAILED QUALITY ASSESSMENTS OF THE NATIONAL DEFENSE STOCKPILE NONFUEL MATERIALS
1984 66 p refs
(NMAB-403) Avail: NTIS HC A04/MF A01

Forty four nonfuel materials, or groups of related materials, were examined for quality assessment. It was found that 18 were usable by today's industry and 12 need no immediate quality assessment. Eight materials need immediate quality assessment because of their critical role in national defense. Summary data on storage conditions and specifications are presented for these materials. Detailed analyses of the entire stockpile should be considered for factors as likelihood of deterioration or contamination, technological changes in specifications, deficiency in analyses, quality data, end use tests or specifications, inability to expeditiously use the material in an emergency, and the cost. It is found that there is a need for detailed evaluation of many materials. E.A.K.

N84-23012*# National Aeronautics and Space Administration. Pasadena Office, Calif.
OIL SHALE EXTRACTION USING SUPER-CRITICAL EXTRACTION Patent Application
Leslie E. Compton, inventor (to NASA) (JPL, California Inst. of Tech., Pasadena) Filed 17 Nov. 1983 25 p
(Contract NAS7-100)
(NASA-Case-NPO-15656-1; US-Patent-Appl-SN-569370) Avail: NTIS HC A02/MF A01 CSCL 08I

Significant improvement in oil shale extraction under supercritical conditions is provided by extracting the shale at a temperature below 400 C, such as from about 250 C to about 350 C, with a solvent having a Hildebrand solubility parameter within 1 to 2 Hb of the solubility parameter for oil shale bitumen. NASA

N84-23013# SKF Technology Services, King of Prussia, Pa.
DEVELOPMENT OF A 3-D MICROSCALE TOPOGRAPHY SYSTEM Final Technical Report
B. B. Aggarwal Jun. 1983 49 p
(Contract N00014-82-C-0342)
(AD-A138809; SKF-AT83D011) Avail: NTIS HC A03/MF A01 CSCL 09/2

This report describes the technical work accomplished in the third phase of a program to develop an automated, three-dimensional, quantitative surface topography measurement system using a stereo-pair of scanning electron microscope (SEM) micrographs. The first phase of the program explored the technical feasibility of making quantitative three-dimensional measurements of surface topography using a stereo-pair of SEM micrographs. In the second phase of the program the hardware and the software necessary to implement the surface topography measurement system were developed and the integrated system was tested to verify its performance. The objectives of the third phase of the program were to provide a data display capability for the system and to refine the system to improve its performance. The hardware and software procured for the data display capability is described in Section 2. The statistical software module for the computation of physical surface features is described in Section 3. Graphics display software to draw surface profiles and contour maps is described in Section 4. Section 5 describes the additional work done in Phase III. The technical status of the program and suggestions for further work are presented in Section 6. GRA

N84-23014# California Univ., Berkeley. Lawrence Berkeley Lab. Earth Sciences Div.
ANALYSIS OF PRODUCTION DATA FROM THE KRAFLA GEOTHERMAL FIELD, ICELAND
K. Pruess, G. S. Bodvarsson, and V. Stefansson (National Energy Authority of Iceland) Dec. 1983 9 p refs Presented at the 9th Workshop on Geothermal Reservoir Eng., Stanford, Calif., 13-15 Dec. 1983 Sponsored in part by the State Electric Power Works of Iceland
(Contract DE-AC03-76SF-00098)
(DE84-006881; LBL-17145; CONF-831253-9) Avail: NTIS HC A02/MF A01

The analysis of flow rate and enthalpy data from several wells completed in the same two-phase zone of Krafla geothermal reservoir has yielded consistent relative permeability parameters. It is found that k sub rl + k sub rv = 1 over the entire range of two-phase flow conditions from immobile liquid to immobile vapor. The available data provide relative permeability parameters as a function of flowing enthalpy only. The relationship between flowing enthalpy and in-place vapor saturation remains unknown, so that the relative permeability information obtained is of limited value for qualitative modeling of geothermal reservoir performance. Numerical simulation of flow rate and enthalpy transients has yielded excellent matches to production data from well 12. However, there is little information about the reservoir which can be deduced in an unambiquous way, because the field data could be matched with a variety of rather different parameter choices. The only unambiguous piece of information obtained is that the water injected into the well during drilling and completion remains in the vicinity of the wellbore during several weeks of warmup. DOE

N84-23015# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
EXPERIMENTAL INVESTIGATIONS OF RIVULET MEANDERS Thesis [EXPERIMENTELLE UNTERSUCHUNGEN ZUM RINNASALMAEANDER]
M. Sieber May 1983 92 p refs In GERMAN
(MPIS-5/1983; ISSN-0436-1199) Avail: NTIS HC A05/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 19,80

The meandering of water rivulets was studied on a plexiglass plate 150 cm long and 90 cm wide, as a function of flows between 1 and 6cucm/sec and inclinations between 6 and 45 deg. The stability limit between straight and meandering rivulets was determined. The meander form was studied by 300 pictures of stable meanders, Fourier analyzed in digitized form. The meander wavelength and amplitude increase with increasing flow and inclination. For higher inclination angle, the domain of stable meanders shifts to smaller flow and becomes narrower. These laws can empirically be described by a linear relation between dimensionless numbers. Author (ESA)

N84-23016# Centre de Recherches en Physique de l'Environnement, Issy-les-Moulineaux (France).
EVAPORATION FROM A BARE SOIL EVALUATED FROM A SOIL WATER TRANSFER MODEL USING REMOTELY SENSED SURFACE SOIL MOISTURE DATA
L. Prevot, R. Bernard, O. Taconet, D. Vidal-Madjar, and J. L. Thony (Institut de Mecanique de Grenoble, France) Jan. 1983 30 p refs Sponsored by CNES
(CRPE-NT-125) Avail: NTIS HC A03/MF A01

Daily surface soil moisture data, obtained with a C-band scatterometer on a bare soil, are used as the upper boundary condition of a numerical soil water transfer model. The model uses an implicit finite difference scheme to solve the nonlinear Richard's equation. Soil is represented as a two layer medium, differing by their hydraulic conductivities. The model is adjusted, by comparison between calculated and measured soil moisture profiles, and provides water budget and boundary fluxes as output. The evaporation computed from the model is comparable to the

estimation from soil water content measurements (neutron measurements). Author (ESA)

N84-23017 Maryland Univ., College Park.
INCORPORATION OF REMOTELY SENSED SOIL MOISTURE DATA INTO A HYDROLOGIC RUNOFF MODEL Ph.D. Thesis
Kenneth Robert Bell 1983 244 p
Avail: Univ. Microfilms Order No. DA8402530

The major objective of the report was the development of a passive microwave-surfacial soil moisture prediction model and the incorporation of the model into a hydrological runoff model. In order to meet the goals of this research project, an extensive computer analysis was performed to determine the best possible correlation between the soil moisture data and the remote sensing data. The major portion of the data used in the analysis was collected from a test site in South Dakota during nine NASA soil moisture missions during 1976, 1977 and 1978. It has been concluded from this analysis that: (1) the best correlation between the remote sensing data and the soil moisture exists for a very limited surficial layer (0-1 deg); (2) the best correlation exists for prediction models using the L-band at 0 deg nadir look angle data than any other microwave band data investigated; (3) of the three model formats investigated (percent soil moisture, percent field capacity, and percent free water), no one model was statistically shown to be a better method for developing the correlation; and (4) the major part of the variability associated with the final model is due to the limit of accuracy of the moisture values used in developing the prediction equation. Dissert. Abstr.

N84-23503*# Oregon State Univ., Corvallis. School of Oceanography.
EXPERIMENTS EXAMINING THE SHAPES OF ISOLATED BARS IN COMPARISON WITH THOSE OCCURRING IN BRAIDED RIVERS
Paul D. Komar *In* NASA. Washington Rept. of Planetary Geol. Programs Apr. 1984 p 198-199 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 08H

N84-23504*# Oregon State Univ., Corvallis. School of Oceanography.
THE EROSION OF STREAMLINED ISLANDS, LONGITUDINAL GROOVES AND SCOUR MARKS: IMPLICATIONS TO THE ORIGIN OF THE MARTIAN OUTFLOW CHANNELS
Paul D. Komar *In* NASA. Washington Rept. of Planetary Geol. Programs Apr. 1984 p 200-202 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 08H

N84-23511*# Geological Survey, Flagstaff, Ariz.
MULTIPROCESS EVOLUTION OF LANDFORMS IN THE KHARGA REGION, EGYPT: APPLICATIONS TO MARS
C. S. Breed, J. F. McCauley, and M. J. Grolier *In* NASA. Washington Rept. of Planetary Geology Program, 1983 Apr. 1984 p 225-227 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 08B

N84-23526*# Arizona State Univ., Tempe. Dept. of Geology.
PINACATE-GRAN DESIERTO REGION, MEXICO: SIR-A DATA ANALYSIS
P. Christensen, R. Greeley, J. McHone, Y. Asmerom, and S. Barnett *In* NASA. Washington Rept. of Planetary Geology Program, 1983 Apr. 1984 p 270 (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 08B

N84-23527*# Arizona State Univ., Tempe. Dept. of Geology.
RADAR-VISIBLE WIND STREAKS IN THE ALTIPLANO OF BOLIVIA
Ronald Greeley and Philip Christensen *In* NASA. Washington Rept. of Planetary Geology Program, 1983 Apr. 1984 p 271-272 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 08B

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N84-23018* National Aeronautics and Space Administration. Pasadena Office, Calif.
WIND AND SOLAR POWERED TURBINE Patent
Ivan D. Wells (California Inst. of Tech., Pasadena), Jin L. Koh (California Inst. of Tech., Pasadena), and Marvin Holmes, inventors (to NASA) (California Inst. of Tech., Pasadena) Issued 28 Feb. 1984 10 p Filed 19 May 1982 Sponsored by NASA
(NASA-Case-NPO-15496-1; US-Patent-4,433,544;
US-Patent-Appl-SN-379602; US-Patent-Class-60-641.12;
US-Patent-Class-60-698; US-Patent-Class-60-716;
US-Patent-Class-290-55; US-Patent-Class-415-2R;
US-Patent-Class-415-DIG.8) Avail: US Patent and Trademark Office CSCL 10A

A power generating station having a generator driven by solar heat assisted ambient wind is described. A first plurality of radially extendng air passages direct ambient wind to a radial flow wind turbine disposed in a centrally located opening in a substantially disc-shaped structure. A solar radiation collecting surface having black bodies is disposed above the fist plurality of air passages and in communication with a second plurality of radial air passages. A cover plate enclosing the second plurality of radial air passages is transparent so as to permit solar radiation to effectively reach the black bodies. The second plurality of air passages direct ambient wind and thermal updrafts generated by the black bodies to an axial flow turbine. The rotating shaft of the turbines drive the generator. The solar and wind drien power generating system operates in electrical cogeneration mode with a fuel powered prime mover. Official Gazette of the U.S. Patent and Trademark Office

N84-23019* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
PHOTOELECTROCHEMICAL CELLS INCLUDING CHALCOGENOPHOSPHATE PHOTOELECTRODES Patent
Benjamin Reichman (Christopher Newport Coll.) and Charles E. Byvik, inventors (to NASA) (Christopher Newport Coll.) Issued 27 Mar. 1984 8 p Filed 7 Oct. 1982 Sponsored by NASA
(NASA-Case-LAR-12958-1; US-Patent-4,439,301;
US-Patent-Appl-SN-433196; US-Patent-Class-204-278;
US-Patent-Class-204-DIG.3; US-Patent-Class-104-DIG.4;
US-Patent-Class-204-129; US-Patent-Class-204-280;
US-Patent-Class-429-111; US-Patent-Class-423-303) Avail: US Patent and Trademark Office CSCL 10A

Photoelectrochemical cells employing chalcogenophosphate (MPX3) photoelectrodes are described where M is selected from the group of transition metal series of elements beginning with scandium (atomic number 21) through germanium (atomic number 32) yttrium (atomic number 39) through antimony (atomic number 51) and lanthanum (atomic number 57) through polonium (atomic number 84); P is phosphorus; and X is selected from the chalogenide series consisting of sulfur, selenium, and tellurium. These compounds have bandgaps in the desirable range from 2.0 eV to 2.2 eV for the photoelectrolysis of water and are stable when used as photoelectrodes for the same.

Official Gazette of the U.S. Patent and Trademark Office

N84-23020*# National Aeronautics and Space Administration. Pasadena Office, Calif.
CHEMICALLY RECHARGEABLE BATTERY Patent Application
Roger M. Williams (JPL, California Inst. of Tech., Pasadena), John J. Rowlette (JPL, California Inst. of Tech., Pasadena), and James

E. Graf, inventors (to NASA) (JPL, California Inst. of Tech., Pasadena) Filed 28 Apr. 1983 19 p Sponsored by NASA
(NASA-CASE-NPO-16024-1; US-Patent-Appl-SN-489692) Avail: NTIS HC A02/MF A01 CSCL 10C

The extent of chemical rechargin of discharged iron electrodes of an iron air battery is significantly increased by utilizing nonaqueous, polar liquid reducing agents such as lower alkanols, particularly methanol, either alone or containing 10 to 60% of other reducing agents, such as formaldehyde and by conducting recharge at elevated temperatures of 20 deg C to 120 deg C and in presence of base such as 0.1 to 6 M of alkali metal hydroxide or alkoxide. The recharge reaction can be further enhanced in an aqueous or nonaequeous liquid reductant if an inert counterelectrode such as palladium or platinum is connected to the discharged metal electrode without external bias, or an applied bias of from 0.1 to 1.0 V is applied to the electrodes, from potential source. E.A.K.

N84-23021*# TRW Space Technology Labs., Redondo Beach, Calif.
STUDY OF SOLAR ARRAY SWITCHING POWER MANAGEMENT TECHNOLOGY FOR SPACE POWER SYSTEM Progress Report, Oct. 1980 - Sep. 1981
J. E. Cassinelli Sep. 1982 33 p
(Contract NAS3-22656)
(NASA-CR-167890; NAS 1.26:167890) Avail: NTIS HC A03/MF A01 CSCL 10A

This report documents work performed on the Solar Array Switching Power Management Study. Mission characteristics for three missions were defined to the depth necessary to determine their power management requirements. Solar array switching concepts were identified that could satisfy the mission requirements. These switching concepts were compared with a conventional buck regulator system on the basis of cost, weight and volume, reliability, efficiency and thermal control. For the missions reviewed, solar array switching provided significant advantages in all areas of comparison. Author

N84-23022*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A 37.5-kW POINT DESIGN COMPARISON OF THE NICKEL-CADMIUM BATTERY, BIPOLAR NICKEL-HYDROGEN BATTERY, AND REGENERATIVE HYDROGEN-OXYGEN FUEL CELL ENERGY STORAGE SUBSYSTEMS FOR LOW EARTH ORBIT
Michelle A. Manzo and Mark A. Hoberecht 1984 11 p Proposed for presentation at the 19th Intersoc. Energy Conversion Eng. Conf., San Francisco, 19-24 Aug. 1984; sponsored by ANS, ASME, SAE, IEEE, AIAA, ACS, and American Inst. for Chemical Engineering
(NASA-TM-83651; E-2016; NAS 1.15:83651) Avail: NTIS HC A02/MF A01 CSCL 10C

Nickel-cadmium batteries, bipolar nickel-hydrogen batteries, and regenerative fuel cell storage subsystems were evaluated for use as the storage subsystem in a 37.5 kW power system for space station. Design requirements were set in order to establish a common baseline for comparison purposes. The storage subsystems were compared on the basis of effective energy density, round trip electrical efficiency, total subsystem weight and volume, and life. Author

N84-23023*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DESIGN CONSIDERATIONS FOR A 10-kW INTEGRATED HYDROGEN-OXYGEN REGENERATIVE FUEL CELL SYSTEM
Mark A. Hoberecht, Thomas B. Miller, Lorra L. Rieker, and Olga D. Gonzalez-Sanabria 1984 13 p refs Proposed for presentation at the 19th Intersoc. Energy Conversion Eng. Conf., San Francisco, 19-24 Aug. 1984; sponsored by ANS, ASME, SAE, IEEE, AIAA, ACS and AIChE
(NASA-TM-83664; E-2041; NAS 1.15:83664) Avail: NTIS HC A02/MF A01 CSCL 10B

Integration of an alkaline fuel cell subsystem with an alkaline electrolysis subsystem to form a regenerative fuel cell (RFC) system for low earth orbit (LEO) applications characterized by relatively high overall round trip electrical efficiency, long life, and high reliability is possible with present state of the art technology. A hypothetical 10 kW system computer modeled and studied based on data from ongoing contractual efforts in both the alkaline fuel cell and alkaline water electrolysis areas. The alkaline fuel cell technology is under development utilizing advanced cell components and standard Shuttle Orbiter system hardware. The alkaline electrolysis technology uses a static water vapor feed technique and scaled up cell hardware is developed. The computer aided study of the performance, operating, and design parameters of the hypothetical system is addressed. E.A.K.

N84-23024*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DESIGN OF A 1-kWh BIPOLAR NICKEL HYDROGEN BATTERY
Robert L. Cataldo 1984 9 p refs Proposed for presentation at the 19th Intersoc. Energy Conversion Eng. Conf., San Francisco, 19-14 Aug. 1984; sponsored by ANS, ASME, SAE, IEEE, AIAA, ACS and AIChE
(NASA-TM-83647; E-2037; NAS 1.15:83647) Avail: NTIS HC A02/MF A01 CSCL 10C

The design of a nickel hydrogen battery utilizing bipolar construction in a common pressure vessel is discussed. Design features are as follows: 40 ampere-hour capcity, 1 kWh stored energy as a 24 cell battery, 1.8 kW delivered in a LEO Cycle and maximum pulse power of 18.0 kW. Author

N84-23025*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ADVANCED DESIGNS FOR IPV NICKEL-HYDROGEN CELLS
John J. Smithrick, Michelle A. Manzo, and Olga D. Gonzalez-Sanabria 1984 8 p refs To be presented at the 19th Intersoc. Energy Conversion Eng. Conf., San Francisco, 19-24 Aug. 1984
(NASA-TM-83643; E-2052; NAS 1.15:83643) Avail: NTIS HC A02/MF A01 CSCL 10C

Advanced designs for individual pressure vessel nickel-hydrogen cells have been concieved which should improve the cycle life at deep depths-of-discharge. Features of the designs which are new and not incorporated in either of the contemporary cells (Air Force/Hughes, Comsat) are: (1) use of alternate methods of oxygen recombination, (2) use of serrated edge separators to facilitate movement of gas within the cell while still maintaining required physical contact with the wall wick, and (3) use of an expandable stack to accommodate some of the nickel electrode expansion. The designs also consider electrolyte volume requirements over the life of the cells, and are fully compatible with the Air Force/Hughes design. Author

N84-23026*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TEARDOWN ANALYSIS OF A TEN CELL BIPOLAR NICKEL-HYDROGEN BATTERY
Michelle A. Manzo, Olga D. Gonzalez-Sanabria, James S. Herzau, and Lois J. Scaglione 1984 13 p refs To be presented at the 19th Intersoc. Energy Conversion Eng. Conf., San Francisco, 19-24 Aug. 1984
(NASA-TM-83618; E-2051; NAS 1.15:83618) Avail: NTIS HC A02/MF A01 CSCL 10C

Design studies have identified bipolar nickel-hydrogen batteries as an attractive storage option for high power, high voltage applications. A pre-prototype Ni-H2 battery was designed, assembled and tested in the early phases of a concept verification program. The initial stack was built with available hardware and components from past programs. The stack performed well. After 2000 low-earth-orbit cycles the stack was dismantled in order to allow evaluation and analysis of the design and components. The results of the teardown analysis and recommended modifications are discussed. Author

N84-23027*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE EFFECT OF DIFFUSION INDUCED LATTICE STRESS ON

THE OPEN-CIRCUIT VOLTAGE IN SILICON SOLAR CELLS
V. G. Weizer and M. P. Godlewski 1984 10 p refs Presented at the 17th Photovoltaic Specialists Conf., Kissimmee, Fla., 1-4 May 1984
(NASA-TM-83667; E-2110; NAS 1.15:83667) Avail: NTIS HC A02/MF A01 CSCL 10C

It is demonstrated that diffusion induced stresses in low resistivity silicon solar cells can significantly reduce both the open-circuit voltage and collection efficiency.The degradation mechanism involves stress induced changes in both the minority carrier mobility and the diffusion length. Thermal recovery characteristics indicate that the stresses are relieved at higher temperatures by divacancy flow (silicon self diffusion). The level of residual stress in as-fabricated cells was found to be negligible in the cells tested. Author

N84-23028*# Boeing Aerospace Co., Seattle, Wash.
STUDY OF FLYWHEEL ENERGY STORAGE FOR SPACE STATIONS Final Report
Sidney Gross Feb. 1984 128 p refs
(Contract NAS9-16151)
(NASA-CR-171780; NAS 1.26:171780; D180-27951-1) Avail: NTIS HC A07/MF A01 CSCL 10A

The potential of flywheel systems for space stations using the Space Operations Center (SOC) as a point of reference is discussed. Comparisons with batteries and regenerative fuel cells are made. In the flywheel energy storage concept, energy is stored in the form of rotational kinetic energy using a spinning wheel. Energy is extracted from the flywheel using an attached electrical generator; energy is provided to spin the flywheel by a motor, which operates during sunlight using solar array power. The motor and the generator may or may not be the same device. Flywheel energy storage systems have a very good potential for use in space stations. This system can be superior to alkaline secondary batteries and regenerable fuel cells in most of the areas that are important in spacecraft applications. Of special impotance relative to batteries, are high energy density (lighter weight), longer cycle and operating life, and high efficiency which minimizes the amount of orbital makeup fuel required. In addition, flywheel systems have a long shelf life, give a precise state of charge indication, have modest thermal control needs, are capable of multiple discharges per orbit, have simple ground handling needs, and have the potential for very high discharge rate. Major disadvantages are noted. R.J.F.

N84-23029# Army Construction Engineering Research Lab., Champaign, Ill.
WIND POWER GENERATION DESIGN CONSIDERATIONS Final Report
E. Elischer and L. M. Windingland Dec. 1984 34 p
(AD-A138841; CERL-TR-E-191) Avail: NTIS HC A03/MF A01 CSCL 10/2

Guidance is provided for the design of a wind power generation system suitable for Civil Works operational sites. The choice of components for a given system is discussed in terms of the highest efficiency possible at the proposed site. Guidance also is given for site selection to minimize environmental impact and maximize the rotor's wind exposure. GRA

N84-23030# California Univ., Berkeley. Lawrence Berkeley Lab. Earth Sciences Div.
GENERATING CAPACITY OF THE HEBER GEOTHERMAL FIELD, CALIFORNIA
M. J. Lippmann and G. S. Bodvarsson Dec. 1983 13 p refs Presented at the 9th Workshop on Geothermal Reservoir Eng., Stanford, Calif., 13-15 Dec. 1983
(Contract DE-AC03-76SF-00098)
(DE84-006883; LBL-16677; CONF-831253-8) Avail: NTIS HC A02/MF A01

Using numerical simulation techniques and the radial model developed for the study of the natural state of the Heber field (Lippmann and Bodvarsson, 1983b), the response of this geothermal system to exploitation is analyzed. In this study the generation rate in the field is allowed to build up over a period of 10 years: after that, 30 years of constant power production is assumed. Full (100%) injection of the spent brines is considered, the fluids being injection 2250 m (near injection) or 4250 m (far injection) from the center of the system. The study shows that a maximum of 6000 kg/s (equivalent to approximately 300 MW sub e of fluids may be produced for the near injection case, but only 3000 kg/s (equivalent to approximately 150 MW sub e for the far injection case. The results indicate that the possible extraction rates (generating capacity) generally are limited by the pressure drop in the reservoir. The average temperature of the produced fluids will decline 10 to 18c over the 40-year period. DOE

N84-23031# General Electric Co., Philadelphia, Pa. Advanced Energy Programs Dept.
DESIGN AND DEVELOPMENT OF A HYBRID TRACKER POINT FOCUS FRESNEL PASSIVELY COOLED CONCENTRATOR PHOTOVOLTAIC ARRAY
Nov. 1983 194 p refs
(Contract DE-AC04-76DP-00789)
(DE84-006365; SAND-83-7026) Avail: NTIS HC A09/MF A01

The design and development of an evolutionary concentrating photovoltaic array is described. The goal of this program was to develop a reliable PV concentrator array suitable for intermediate to central station power applications. The 9.4 kW array developed uses eighty passively cooled point focus Fresnel concentrator modules mounted onto a new tilt-roll tube tracker. A key feature of the technical approach was that commercial contractors were used in the design and fabrication of several of the critical subsystems: tracker structure, microprocessor based controller and silicon cell mounts. The aim of this approach has been to maximize the near term production potential of these critical array subsystems and components. DOE

N84-23032# Martin Marietta Corp., Denver, Colo. Div. 3151.
MANUFACTURING COST ANALYSIS FOR PHOTOVOLTAIC CONCENTRATOR TRACKING STRUCTURES
B. Heller, N. Pass, and R. Blackwell Nov. 1983 400 p refs
(Contract DE-AC04-76DP-00789)
(DE84-006318; SAND-82-7151) Avail: NTIS HC A17/MF A01

Detailed manufacturing, transportation and installation costs are developed for the current design of three different photovoltaic concentrator tracking structures at a production rate of 10 to the 5th power/sq m per year. These costs are combined with array field performance estimates to obtain cost per watt and levelized energy costs for 500 kW fields. Installed structure costs for the three arrays (including G and A and profit but not module FOB costs) range from $166 to $208/sqm, or $1.04 to $1.28/W sub ap in 1982 dollars. The pedestal tracking structure has a lower cost than the post/frame or pylon/torque tube arrays. DOE

N84-23033# Rockwell International Corp., Golden, Colo. Wind Energy Research Center.
PERFORMANCE AND SIZE ESTIMATING FOR WIND SYSTEMS
R. L. Moment Feb. 1983 72 p refs
(Contract DE-AC04-76DP-03533)
(DE84-006980; RFP-3586) Avail: NTIS HC A04/MF A01

A method is described for estimating wind energy conversion system (WECS) performance, given wind speed, and annual energy production in common wind regimes (V = 10 to 18 mph) for different rotor diameters ranging from 10 to 140 ft. Results obtained using this method were verified for one WECS using a rotor performance code coupled with drive train efficiency tables. A collection of curves is included for the various wind regimes and rotor sizes, system Cp values from 0.25 to 0.35, and rated wind speeds from 20 mph to 35 mph which allow the reader to estimate performance from a given size machine or select the rotor size required to produce a given amount of energy. These curves show that a minimum rotor diameter exists for a specified level of energy production. Plots are also presented which illustrate the effect of wind regime on annual energy generated and the relationships between rated wind speed and average wind speed.

A procedure to develop similar curves for individual specific conditions is outlined. DOE

N84-23034# European Space Agency, Paris (France).
THERMODYNAMIC MODEL FOR A CENTRAL RECEIVER OF A SOLAR PLANT WITH PARTIAL SHADING OF THE HELIOSTAT FIELD
Josef Reinkenhof Sep. 1983 119 p refs Trans. into ENGLISH of "Thermodyn. Rechenmodell fuer den Solarabsorber eines Turmkraftwerks bei Teilabschattung des Heliostatfeldes' Rept. No. DFVLR-FB-82-27 DFVLR, (West Germany), Hardthausen, Jul. 1982
(ESA-TT-807; DFVLR-FB-82-27) Avail: NTIS HC A06/MF A01; original German version available from DFVLR, Cologne DM 39,10

The time dependent loss mechanisms of a heliostat field and a stochastic model for the simulation of partial shading of the heliostat field are discussed. The coupling of the heliostat field with the receiver is reduced to the problem of an aperture covered with directed energy sources and sinks. A two-dimensional normal distribution is selected as the intensity distribution over the aperture. The energy flux can be calculated for any point within the receiver. The local heat flux into the walls of a reveiver with arbitrary geometry is estimated. The case of isothermal walls with re-emitted radiation escaping through the aperture is treated. Author (ESA)

N84-23035# GKSS-Forschungszentrum Geesthacht (West Germany). Zentralabteilung Technikum.
WIND ENERGY TEST FIELD PELLWORM: TESTS OF THE PLANT BRUEMMER BW 120S Final Report [WINDKRFTANLAGEN-VERSUCHSFELD PELLWORM: ABSCHLUSSBERICHT UEBER DIE ERPROBUNG DER ANLAGE BRUEMMER BW 120S]
S. Fries, J. Bruegmann, G. Petersen, and H.-T. Mengelkamp 1983 49 p refs In GERMAN; ENGLISH summary
(GKSS-83-E-42) Avail: NTIS HC A03/MF A01

The wind energy converter Bruemmer BW 120S was tested on site for 25 months. Qualitative and quantitative test results are described. A definitive power curve is determined. By means of this curve the annual energy production for a site with a known annual mean wind speed can be calculated. Author (ESA)

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N84-23036# Drexel Univ., Philadelphia, Pa. Dept. of Physics and Atmospheric Science.
EFFECTS OF MESOSCALE WEATHER DISTRUBANCES ON CONTAMINATION CONCENTRATIONS Final Report
Carl Kreitzberg 30 Jan. 1984 8 p
(Contract DE-AC02-76EV-02360)
(DE84-005753; DOE/EV-02360/1) Avail: NTIS HC A02/MF A01

Mesoscale weather disturbances can have significant cleansing effects upon atmospheric contamination concentrations. The complicated dynamics of such disturbances make it difficult with present techniques to establish quantitative causal relationships between concentrations measured at sampling points and the magnitudes of contaminants inserted into the air at source points. DOE

N84-23037# Rolls-Royce Ltd., Derby (England).
AIRCRAFT NOISE LEGISLATION: AN OVERKILL
M. J. T. Smith 1 Dec. 1982 12 p Presented at Australian Acoustical Soc., Sydney, Dec. 1982
(PNR-90167; Reprint-870) Avail: NTIS HC A02/MF A01

The cost to the aircraft industry of noise legislation is criticized. The need to rationalize noise certification procedures is pointed out. The relative contribution of high and low bypass engines to noise pollution is assessed. Author (ESA)

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation.*

N84-23038 Rhode Island Univ., Kingston.
BORON IN THE MARINE ATMOSPHERE Ph.D. Thesis
Thomas R. Fogg 1983 339 p
Avail: Univ. Microfilms Order No. DA8401407

Atmospheric boron was simultaneously separated into gaseous and particulate components for the first time by passing air through a simple impregnated filter sampling system. A Nuclepore filter collected particular boron and preceded KOH impregnated Whatman 41 filters for gaseous boron collection. Boron was determined by visible spectrophotometry. The method was developed to allow daily measurements of atmospheric boron. The results show that boron exists in the atmosphere primarily in the gas phase. Gaseous boron concentrations collected at several sites in the Northern Hemisphere ranged from 1-233 ng/cu m while particulate boron ranged from 0.02-8 ng/cu m. A four month series of daily samples collected at Narragansett, R.I. revealed gaseous boron variations to exist on a time scale of several days. Estimate of inputs of boron to the troposphere reveal that the ocean and vulcanism are the major natural sources, dominating anthropogenic sources, such as coal combustion, by a factor of approx 10. Dissert. Abstr.

N84-23039*# TRW Systems and Energy, Redondo Beach, Calif.
ONGOING DATA REDUCTION, THEORETICAL STUDIES AND SUPPORTING RESEARCH IN MAGNETOSPHERIC PHYSICS Semiannual Progress Report, Oct. 1983 - Mar. 1984
F. L. Scarf and E. W. Greenstadt 12 Apr. 1984 10 p refs
(Contract NASw-3690)
(NASA-CR-173419; NAS 1.26:173419; TRW-40789-6009-UT-00) Avail: NTIS HC A02/MF A01 CSCL 04A

Data from ISEE-3, Pioneer Venus Orbiter, and Voyager 1 and 2 were analyzed. The predictability of local shock macrostructure at ISEE-1, at the Earth's bow shock, from solar wind measurements made up-stream by ISEE-3, was conducted using computer graphic format. Morphology of quasi-parallel shock was reviewed. The review attempted to interrelate various measurements and computations involving the q-parallel structure and foreshock elements connected to it. A new classification for q-parallel morphology was suggested. Author

N84-23040# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
ATMOSPHERIC CORRECTION STUDY/ATMOSPHERIC MODEL OPTIMIZATION [ESTUDO DE CORRECAO ATMOSFERICA/ OTIMIZACAO DE MODELO ATMOSFERICO]
Chiyomi Kawashima Nov. 1983 106 p refs In PORTUGUESE; ENGLISH summary
(INPE-2969-RPE/448) Avail: NTIS HC A06/MF A01

In order to make atmospheric correction of an image, two parameters are very necessary: transmittance and radiance. These parameters are calculated using the program LOWTRAN 5 developed in the USA by Air Force Geophysics Laboratory. The modification of LOWTRAN 5, enabling it to be interactive in order to make its use easier and less complex is explained. As LOWTRAN 5 was developed for a CDC-6600, it was necessary to adapt it for a Burroughs 6800. This new version is known as LOWT5. Author

N84-23041*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ENERGETICS OF THE MAGNETOSPHERE, REVISED
David P. Stern Feb. 1984 42 p refs Previously announced as N81-12681 Submitted for publication
(NASA-TM-86063; NAS 1.15:86063) Avail: NTIS HC A03/MF A01 CSCL 04A

The approximate magnitudes of power inputs and energies

associated with the Earth's magnetosphere were derived. The nearest 40 R sub E of the plasma sheet current receive some 3.10 to the 11th power watt, and much of this goes to the Birkeland currents, which require 1-3 10 to the 11th power watt. Of that energy, about 30% appears as the energy of auroral particles and most of the rest as ionosphere joule heating. The ring current contains about 10 to the 15th power joule at quiet times, several times as much during magnetic storms, and the magnetic energy stored in the tail lobes is comparable. Substorm energy releases may range at 1.5 to 30 10 to the 11th power watt. Compared to these, the local energy release rate by magnetic merging in the magnetosphere is small. Merging is essential for the existence of open field lines, which make such inputs possible. Merging also seems to be implicated in substorms: most of the released energy only becomes evident far from the merging region, though some particles may gain appreciable energy in that region itself, if the plasma sheet is squeezed out completely and the high latitude lobes interact directly. E.A.K.

N84-23042# Naval Postgraduate School, Monterey, Calif.
COHERENCE STUDY OF GEOMAGNETIC FLUCTUATIONS IN FREQUENCY RANGE .04 - 0.6 HZ BETWEEN REMOTE LAND SITES M.S. Thesis
S. J. Anthony Dec. 1983 144 p
(AD-A138542) Avail: NTIS HC A07/MF A01 CSCL 08/14

Fluctuations in the geomagnetic field were measured by three orthogonally mounted coil sensors at two land sites separated by 40 km. Computer generated voltage vs time and magnetic field vs time plots failed to reveal the presence of dominant micropulsations. A coherence study between the two sites revealed coherence values of 0.6 - 0.8 in the frequency range 0.4 - 0.6 Hz. This is compared to a coherence study completed at the Naval Air Development Center, Warminster, Pennsylvania, between land sites 24.8 km apart. The NADC coherence values are lower (0.3 - 0.6). GRA

N84-23043# Naval Research Lab., Washington, D. C.
RAYLEIGH-TAYLOR INSTABILITY IN THE PRESENCE OF A STRATIFIED SHEAR LAYER
P. Satyanarayana, P. N. Guzdar, J. D. Huba, and S. L. Ossakow 16 Feb. 1984 59 p
(RR0-3302; S99-QMXB)
(AD-A138544; NRL-MR-5263) Avail: NTIS HC A04/MF A01 CSCL 04/1

A nonlocal theory of the Rayleigh-Taylor instability which includes the effect of a transverse velocity shear is presented. A two fluid model is used to describe an inhomogeneous plasma under the influence of gravity and sheared equilibrium flow velocity, and to derive a differential equation describing the generalized Rayleigh-Taylor instability. An extensive parametric study is made in the collisionless and collisional regime, and the corresponding dispersion curves are presented. The results are applied to the equatorial F region and to barium releases in the ionosphere. Author (GRA)

N84-23044# Air Force Geophysics Lab., Hanscom AFB, Mass.
F-LAYER IONIZATION PATCHES IN THE POLAR CAP
E. J. Weber, J. Buchau, J. G. Moore, J. R. Sharber, and R. C. Livingston 5 Oct. 1983 36 p
(AF Proj. 4643)
(AD-A138633; AFGL-TR-83-0276; AFGL-ERP-859) Avail: NTIS HC A03/MF A01 CSCL 04/1

Ground based optical and digital ionosonde measurements were conducted at Thule, Greenland, to measure ionospheric structure and dynamics in the nighttime polar cap F-layer. These observations showed the existence of large scale (800-1000 km) plasma patches drifting in the anti-sunward direction during a moderately disturbed (Kp > 4) period. Simultaneous Dynamics Explorer (DE-2) Low Altitude Plasma Instrument (LAPI) measurements show that these patches, with peak densities of approx. = 1000000 el 1/cm 3, are not locally produced by structured particle precipitation. The LAPI measurements show a uniform precipitation of polar-rain electrons over the polar cap. The combined measurements provide a comprehensive description of patch structure and dynamics. They are produced near or equatorward of the dayside auroral zone, and convect across the polar cap in the anti-sunward direction. As gradients within the large scale, drifting patches are subject to structuring by convective instabilities. The resulting irregularity distribution within the patches is mapped using UHF scintillation and spaced-receiver measurements. Author (GRA)

N84-23045# Air Force Geophysics Lab., Hanscom AFB, Mass.
OBSERVATIONS OF MAJOR STRATOSPHERIC CHLORINE SPECIES Final Scientific Report
C. C. Gallagher and C. A. Forsberg 24 Oct. 1983 21 p
(AF Proj. 6687)
(AD-A138646; AFGL-TR-83-0284; AFGL-ERP-860) Avail: NTIS HC A02/MF A01 CSCL 04/1

A cryogenic whole air sampler (Tri-Sampler) and a Direct Flow Sampler (DFS), a motor-driven filter sampler, are used simultaneously on a balloon platform with the goal of sampling all significant stratospheric chlorine compounds to permit determination of total chlorine content in the lower stratosphere, Gas chromatographic techniques are applied to the retrieved whole air samples, to determine volume mixing ratios of CF2Cl2, CFCl3, CH3Cl, CH3CCl3, and CCl4. Specially treated filters are used with the DFS to capture all acidic and participate chlorine compounds. The filter samples are analyzed using wet chemistry and neutron-activation analysis techniques. Three balloon flights were conducted during 1981-1982 and simultaneous samplings were obtained at various altitudes form 15 to 30 km. Mixing-ratio lapse rates for the species analyzed by gas chromatography are consistent with those species being of tropospheric origin. Also, stratospheric abundances of CFCl3 and CF2Cl2 exhibited minimal changes over several years, although the tropospheric abundances of these species are known to increase at about 10 percent per year in the Northern Hemisphere. GRA

N84-23046# Open Univ., Milton (England). Faculty of Technology.
ACOUSTIC-TO-SEISMIC COUPLING OVER POROUS GROUND SURFACES Final Technical Report, Jun. 1981 - Oct. 1983
K. Attenborough, N. W. Heap, T. L. Richards, and V. V. S. S. Sastry Jan. 1984 202 p
(Contract DAJA37-81-C-0210; DA Proj. 1T1-61102-BH-57)
(AD-A138753) Avail: NTIS HC A10/MF A01 CSCL 20/11

Contents: Transmission of a Spherical Wave at a Rigid Porous Interface; Point to Point Propagation Measurements Using Acoustic Modelling; Ground as a Rigid Porous Medium; Ground as a Poro-Elastic Medium: Response to Plane Waves; The Surface Motion of a Poroelastic Half-Space Due to an Incident Spherical Sound Wave; Weyl-Van Der Pol Formula: Confirmation; On the Acoustic Surface Wave Near a Rigid Porous Boundary; The Acoustic Modelling Facility; Calculation of Surface Intensity Ratios; Motion of Interface: The Geometric Approximation. GRA

N84-23047# Naval Research Lab., Washington, D. C.
LONG WAVELENGTH LIMIT OF INTERCHANGE INSTABILITIES
J. D. Huba and S. T. Zalesak 23 Feb. 1984 27 p
(DNA Proj. S99-QMXB; RR0-3302)
(AD-A138943; NRL-MR-5261) Avail: NTIS HC A03/MF A01 CSCL 12/1

Derived is a general, nonlocal dispersion equation which describes the long wavelength limit of several interchange instabilities (viz., Rayleigh-Taylor, E x B gradient drift, and current convective). Analytical expressions for the growth rate of these modes are presented in both the collisional and collisionless regimes. The scaling of these growth rates with wavenumber (k) and the Pedersen conductivity ratio (M) are explicitly stated. Author (GRA)

N84-23048# Mathematical Geosciences, Inc., Lexington, Mass.
GEODETIC USE OF GEOSAT-A Final Report, 16 Sep. 1982 - 30 Aug. 1983

E. M. Gaposchkin Aug. 1983 69 p
(Contract F19628-82-C-0144; AF Proj. 3201)
(AD-A137993; AFGL-TR-83-0254) Avail: NTIS HC A04/MF A01 CSCL 08/5

The Molodensky Integral can be used to compute gravity anomalies from the geoid height. There are two error sources. The error due to limiting the integral to a spherical cap can, in practice, be reduced by using a low degree and order reference field. For example, with a 6 degree radius cap and a 12th degree and order reference geopotential this error is one milligal. The error due to the geoid height error depends on the gravity anomaly block size and variance of the geoid height error. In this case, a 3 cm rms geoid error will result in a one milligal error for a 28 km x 28 km mean gravity anomaly. Quantitization error of replacing the integral by a summation and the singularity of the Molodensky Kernel are found to contribute in significant errors. The correction for satellite to sea surface altitude measurements due to the wet troposphere (hw) is investigated using Scanning Multichannel Microwave Radiometer (SMMR) data from SEASAT-1. The Mesoscale Eddy field is discussed, and is shown to contribute 8 to 25 cm rms noise to the mean sea surface. GRA

N84-23049# Centre de Recherches en Physique de l'Environnement, Issy-les-Moulineaux (France).
A MIDDLE LATITUDE IONOSPHERIC MODEL [MODELISATION DE L'IONOSPHERE A MOYENNE LATITUDE]
P. Poinsard and C. Taieb Jun. 1982 85 p refs In FRENCH; ENGLISH summary
(CRPE-NT-114) Avail: NTIS HC A05/MF A01

Four coupled second order differential equations were solved using a spectral method in order to build an ionospheric model representative of temperate latitudes. The model depends on time and altitude. All physical phenomena that have measurable influence on ion concentrations are taken into account. Computations results are compared with incoherent scatter measurements and most results agree. Author (ESA)

N84-23050# Centre National de la Recherche Scientifique, Orleans (France). Centre de Recherches sur la Chimie de la Combustion et des Hautes Temperatures.
KINETIC STUDIES OF ATMOSPHERIC REACTIONS OF OH RADICALS
G. Poulet, J. L. Jourdain, G. Laverdet, H. MacLeod, and G. LeBras 1982 4 p Presented at 3rd Meeting on Atmospheric Reactions Involving Free Radicals and Others Reactive Species, Dublin, 5 - 6 Oct. 1982
Avail: NTIS HC A02/MF A01

Kinetic measurements of OH radical reactions in the atmosphere are summarized. Reactions of OH with organic sulfides, nitric acid, and molecular bromine were studied. Author (ESA)

N84-23051# Centre National de la Recherche Scientifique, Orleans (France). Centre de Recherches sur la Chimie de la Combustion et des Hautes Temperatures.
KINETICS AND PRODUCTS OF THE REACTION OH + HNO3
Georges LeBras, Jean-Luc Jourdain, and Gilles Poulet 1982 3 p refs Presented at Intern. Symp. on Chem. Kinetics Related to Atmospheric Chem., Tsukuba, Japan, 6 - 10 Jun. 1982
Avail: NTIS HC A02/MF A01

The kinetics and products of the OH + HNO3 reaction were studied in a reactor. The rate constant was determined, and a quantitative indentification of the products was established. It is shown that the estimation of lower stratospheric ozone depletion by CFMS is greatly dependent on the reaction channel. Author (ESA)

N84-23052# Oulu Univ. (Finland). Dept. of Physics.
OBSERVATIONS OF SHORT PERIOD MAGNETIC PULSATIONS DURING THE SBARMO-79 CAMPAIGN: DATA SUMMARY
J. Niskanen, T. Pikkaarainen, T. Boesinger, and J. Kangas Feb. 1982 48 p refs
(Rept-90/1982; ISBN-951-42-1235-5; ISSN-0356-1852) Avail: NTIS HC A03/MF A01

Short-period magnetic pulsations recorded during auroral substorms by balloons are presented. Pulsation events are shown as standard dynamic spectra with isointensity contours. Author (ESA)

N84-23053# Oulu Univ. (Finland). Dept. of Physics.
QUICK-LOOK TABLES OF CONTINUOUS PULSATIONS (Pc1) AND INTERVALS OF PULSATIONS OF DIMINISHING PERIODS (IPDP) MAGNETIC PULSATION EVENTS RECORDED IN FINLAND DURING IMS YEARS 1976-1979: DATA SUMMARY
T. Pkkarainen, L. Lukkari, J. Niskanen, and J. Kangas Apr. 1982 80 p refs
(Rept-92/1982; ISBN-951-42-1281-9; ISSN-0356-1852) Avail: NTIS HC A05/MF A01

Short period magnetic pulsations recorded at five stations during the IMS are summarized. The occurrence of continuous and diminishing period events is indicated. Each data sheet includes 10 days of observations. Author (ESA)

N84-23054# Centre de Recherches en Physique de l'Environnement, Issy-les-Moulineaux (France).
USER'S MANUAL OF A PROGRAM TO COMPUTE THE DISTRIBUTION OF PHOTOELECTRONS [NOTICE D'UTILISATION D'UN PROGRAMME DE CALCUL DE LA DISTRIBUTION DES PHOTOELECTRONS]
M. L. Duboin and G. Lejeune (Centre d'Etude des Phenomenes Aleatoires et Geophysiques, St Martin d'Heres, France) Feb. 1982 48 p In FRENCH
(CRPE-NT-110) Avail: NTIS HC A03/MF A01

A program to compute the evolution of a flow of electrons in the atmosphere is described. The balance of the energy dissipated during elastic or inelastic scattering is also treated. The program computes production of electrons by solar irradiation, cross sections for all altitudes and energy levels, and the evolution of the flow through the atmosphere. Author (ESA)

N84-23055# Centre de Recherches en Physique de l'Environnement, Issy-les-Moulineaux (France).
CALM IONOSPHERIC DYNAMO. PART 1: SIMULATIONS CARRIED OUT IN 1981 [DYNAMO IONOSPHERIQUE CALME. 1: SIMULATIONS EFFECTUEES AU COURS DE L'ANNEE 1981]
Ch.02Blanc Mazaudier, M., R. Bernard, and C. Hanuise (LSEET, Toulon, France) May 1982 115 p refs In FRENCH
(CRPE-NT-112-Pt-1) Avail: NTIS HC A06/MF A01

Models established from incoherent scattering measurements are used to improve dynamo simulations. The characteristics of the inlet parameters of each simulation, which are the source of the neutral wind and the ionospheric conductivity, are detailed. Simulations carried out within an electrojet study are discussed. Equivalent electric current charts that may be compared to theoretical charts obtained by dynamo simulation are described. It is concluded that the dynamo model should be modified to explain observations. Author (ESA)

N84-23056 Utah Univ., Salt Lake City.
PREDICTION OF ATMOSPHERIC FLOW AND DISPERSION OVER SLOPING TERRAIN Ph.D. Thesis
Eueng-nan Yeh 1983 191 p
Avail: Univ. Microfilms Order No. DA8402162

The pollutants emitted into the air are carried away by wind and diluted by mixing. It is imposible to properly predict the concentration distribution at low levels without knowing the detailed structure of the planetary boundary layer (PBL). For this purpose a fine resolution, nonstationary, dynamic model is constructed, which predicts the spatial and temporal variation of wind, temperature, and diffusivity fields over sloping terrain of mesoscale dimensions. The accuracy of the numerical scheme is verified by analytical solutions. Results of the sensitivity tests of the complete model indicate that the diurnal temperature variation responds most to seasonal change, and the air circulation is also sensitive to soil type as well as latitude. The formation of nocturnal jets during summer at high latitudes agrees well with observations. Dissert. Abstr.

N84-23057 Michigan Univ., Ann Arbor.
THE VERTICAL REDISTRIBUTION OF A POLLUTANT TRACER DUE TO CUMULUS CONVECTION Ph.D. Thesis
John Andrew Ritter 1983 200 p
Avail: Univ. Microfilms Order No. DA8402364

A formalism that incorporates the physical processes responsible for the vertical redistribution of a conservative pollutant tracer due to a convective cloud field is presented and that the cloud venting process should not be neglected in regional-scale modeling is demonstrated. Two modeling approaches are presented which, although both are based on the framework common to the works of Ogura and Cho (1973) and Johnson (1975), differ in the manner in which the cloud field is forced. The first approach (called an implicit model) is adapted from Johnson (1975) wherein the cloud forcing functions are determined from synoptic-scale heat and moisture budgets. The second model (called an explicit model) obtains the forcing functions in a unique way by explicitly incorporating the vertical distribution of cumulus cloud cover, thereby incorporating the influences of subsynoptic-scale phenomena. By comparing the results of these two approaches, the role of subsynoptic-scale phenomena in determining the vertical pollutant transport due to cumulus convection is assessed.
Dissert. Abstr.

N84-23058 California Inst. of Tech., Pasadena.
PHOTOCHEMICAL MODELING OF THE EARTH'S STRATOSPHERE Ph.D. Thesis
Lucien Froidevaux 1984 291 p
Avail: Univ. Microfilms Order No. DA8402489

A one-dimensional photochemical model of the Earth's stratosphere in order to provide an up-to-date comparison with mid-latitude observations. Scattered solar flux measurements (at 40 km) by J. R. Herman and J. E. Mentall. A 10% ratio of scattered to direct flux at 200 nm is unexplainable, without the existence of an unknown scattering component. The first-order effects of the inclusion of the diffuse radiation in a spherical shell atmosphere, for solar zenith angles close to 90 degrees were demonstrated. Changes in model concentrations are largest for short-lived radicals such as O, OH, ClO, and NO in the lower stratosphere, but relatively small compared to current observational uncertanties. We propose that a significant overestimate of the molecular oxygen absorption cross section near 210 nm is in large part responsible for the discrepancy between observed and modeled vertical profiles of some halocarbons (CFCl3 in particular). Dissert. Abstr.

N84-23059 Massachusetts Univ., Amherst.
STRATIGRAPHIC, GEOCHEMICAL, AND PETROLOGIC STUDIES OF THE AMMONOOSUC VOLCANICS, NORTHCENTRAL MASSACHUSETTS AND SOUTHWESTERN NEW HAMPSHIRE Ph.D. Thesis
John Charles Schumacher 1983 250 p
Avail: Univ. Microfilms Order No. DA8401103

The Middle Ordovician Ammonoosuc Volcanics are interpreted as island arc volcanics associated with the Taconian Orogeny, metamorphosed to amphibolite facies during the Devonian. They occur above gneisses in the domes and below the Partridge Formation, and possess an internal strataigraphy of four members in ascending order: Moosehorn Conglomerate, local basal quartz-pebble conglomerate; Lower Member, amphibolites, felsic gneisses, and minor marble; Garnet-Amphibole-Magnetite Quartzite, discontinuous layer of metamorphosed chert; Upper Member, biotite-quartz-feldspar gneisses containing garnet, muscovite, and kyanite or sillimanite. Orthoamphibole and cummingtonite are common in the section that ranges in thickness from 0 to 1200 meters. Major- and trace-element analyses have been performed on 64 samples throughout the section. Many show compositions that have been changed before metamorphism by high- and low-temperature sea water alteration or weathering. Dissert. Abstr.

N84-23060 California Univ., Santa Barbara.
AGE AND EVOLUTION OF THE YUKON-TANANA TERRANE, SOUTHEASTERN YUKON TERRITORY Ph.D. Thesis
James Kenneth Mortensen 1983 172 p
Avail: Univ. Microfilms Order No. DA8401750

The YTT in the study area consists of a regionally mappable structural sequence, interpreted to be original stratigraphy, consisting of metasedimentary rocks mixed with abundant mafic to felsic metavolcanic rocks and invaded by widespread metamorphosed granitic intrusions. This middle and upper Paleozoic (and perhaps order) sequence was highly metamorphosed and deformed, then uplifted and eroded by Late Triassic time, when sedimentary rocks containing clasts of the metamorphic basement were deposited upon it. Structural imbrication followed, with the emplacement of sheared greenstone and mafic to ultramafic plutonic rock along thrust surface. Early Jurassic diorite and monzonite intrusive into the metamorphic sequence appears to be involved in the thrust faulting. Dissert. Abstr.

N84-23061 California Inst. of Tech., Pasadena.
NEOTECTONICS OF THE NORTH FRONTAL FAULT SYSTEM OF THE SAN BERNARDINO MOUNTAINS, SOUTHERN CALIFORNIA: CAJON PASS TO LUCERNE VALLY Ph.D. Thesis
Kristian Erik Meisling 1984 471 p
Avail: Univ. Microfilms Order No. DA8402492

The north frontal fault system of the San Bernardino Mountains is made up of a number of disparate structural elements, each of which accommodates range-front deformation in a manner dictated by its geometry. A two-stage history of late Cenozoic structural development is proposed for the northwestern San Bernardino Mountains; the range was first uplifted on low-angle structures and later modified by high-angle faulting. Thrusting uplifted the northern range front during a pulse of deformation spanning late Pilocene through middle Pleistocene time. Contemporaneous uplift in the westernmost San Bernardino Mountains was accomplished by tilting, warping, and arching, High-angle faulting replaced thrusting and warping as the dominant style of deformation in the northwestern San Bernardino Mountains beginning in middle to late Pleistocene time, accomplishing north-south crustal shortening by squeezing the San Bernardino Mountains block eastward.
Dissert. Abstr.

N84-23062 State Univ. of New York, Albany.
CENOZOIC TECTONICS OF THE CARIBBEAN: STRUCTURAL AND STRATIGRAPHIC STUDIES IN JAMAICA AND HISPANIOLA Ph.D. Thesis
William Paul Mann 1983 777 p
Avail: Univ. Microfilms Order No. DA8401427

Structural and stratigraphic field studies in Jamaica and Hispaniola (Dominican Republic and Haiti) and synthesis of published data from surrounding areas refine previously proposed models for convergent and strike-slip plate interactions in the northern Caribbean. Specifically: (1) new data and regional stratigraphic analysis of major unconformities in the Greater Antilles supports the idea of two distinct arcs that terminated by collision at slightly different times in the latest Cretaceous and Paleogene; (2) field studies in the Port Maria area of northeastern Jamaica essentially complete mapping of the Wagwater Belt, a reactivated Paleogene graben and overlying sedimentary basin; and (3) the interpretation of satellite imagery and aerial photographs and field studies in the Enriquillo Valley and Sierra el Numero, Dominican Republic; the Culde-Sac Valley and southern peninsula of Haiti; and the Clydesdale area of eastern Jamaica. Dissert. Abstr.

N84-23063 Arizona Univ., Tucson.
SEDIMENTARY RESPONSE TO EOCENE TECTONIC ROTATION IN WESTERN OREGON Ph.D. Thesis
Paul Lewis Heller 1983 343 p
Avail: Univ. Microfilms Order No. DA8401264

Published paleomagnetic studies have shown that the Oregon Coast Range s rotated 60 degrees clockwise since middle Eocene time, probably by pivoting either during collision of a seamount terrane or during an episode of asymmetric extension within western North America. Eocene sedimentary deposits within the Oregon Coast Range basin, in particular the Tyee Formation, document changes in basin evolution that provide geologic constraints for proposed rotation models. The Tyee Formation comprises an

arkosic petrofacies which is different from underlying lithic sandstones that were derived from the adjacent Klamath Mountains. Isotopic study of sandstones of the arkosic petrofacies, including Sm-Nd, Rb-Sr, K-Ar, and O 18 analyses indicate that much of the sandstone was not derived from the Klamath Mountains or nearby Sierra Nevada. The source area most likely included S-type granites of the Idaho Batholith. Dissert. Abstr.

N84-23064 George Washington Univ., Washington, D.C.
SEDIMENTOLOGY AND INVERTEBRATE PALEONTOLOGY OF TRIASSIC AND JURASSIC LACUSTRINE DEPOSITS, CULPEPER BASIN, NORTHERN VIRGINIA Ph.D. Thesis
Pamela Jeanne Wheeless Gore 1983 375 p
Avail: Univ. Microfilms Order No. DA8401325

The Culpeper Basin contains late Triassic and early Jurassic continental sedimentary rocks. Lacustrine rocks are present in the Bull Run Formation, Buckland Formation, and Waterfall formation. The lacustrine rocks were grouped into eight lithofacies using cluster analysis: (1) red massive siltstone or mudstone, (2) gray massive siltsone or mudstone, (3) disrupted graded siltstone and mudstone, (4) laminated mudstone, (5) limestone, (6) black shale, (7) red laminated and cross-laminated siltstone, sandstone, and mudstone, and (8) sandstone. Freshwater invertebrate fossils (conchostracans, notostracans, ostracodes, and pelecypods) which inhabited shallow water are abundant in some lacustrine beds. The Culpeper Basin notostracans (Triops) are the first to be reported from the Triassic of North America. The conchostracans, Cyzicus and Cornia may be useful for correlation in the Culpeper Basin. Cyzicus is present in the Triassic Bull Run Formation. Cornia is present in the Jurassic Waterfall Formation. This is the first report of Cornia from the Newark Supergroup. Dissert. Abstr.

N84-23065 Pennsylvania State Univ., University Park.
GEOLOGY AND GEOCHRONOLOGY OF THE SOUTHEAST BORDER OF THE BITTERROOT DOME: IMPLICATIONS FOR THE STRUCTURAL EVOLUTION OF THE MYLONITIC CARAPACE Ph.D. Thesis
Lawrence Garmezy 1983 363 p
Avail: Univ. Microfilms Order No. DA8327491

Geologic and geochronologic study of the southeast corner of the Bitterroot dome has delimited the evolution of the shallow-dipping mylonitic carapace that developed on the granitic rocks of the Bitterroot lobe of the Idaho Batholith. Reset hornblende from the zone of mylonitization, in conjunction with Ar 40/Ar 39 age spectra of hornblende, muscovite, biotite, and K-feldspar from non-mylonitic samples, indicates that mylonitization began approximately 45.5 Ma ago at a depth of probably greater than 9 to 10 km, and continued for approximately 2 Ma, during a period of rapid uplift of the dome (.1 to .3 cm/y). The process of mylonitization caused shear heating of as much as 200 C above ambient conditions. With only two exceptions, detailed kinematic analyses of mylonitic fabric indicate eastward tectonic transport of the hanging wall throughout the 500 to 1000 m-thick mylonitic zone. Dissert. Abstr.

N84-23066 Texas Univ., Austin.
GEOLOGY, GEOCHEMISTRY, AND GEOCHRONOLOGY OF VOLCANIC ROCKS BETWEEN CUAUHTEMOC AND LA JUNTA, CENTRAL CHIHAHUA, MEXICO Ph.D. Thesis
Timothy William Duex 1983 234 p
Avail: Univ. Microfilms Order No. DA8429818

The 1200 sq Km area straddles the boundary between the Sierra Madre Occidental and Basin and Range physiographic provinces and contains three north-northwest trending, block-faulted mountain ranges. The stratigraphy includes a 200 m thick sequence of ash-flow tuffs with subordinate mafic flows that either overlie or are interlayered with the ash-flow tuffs. This sequence overlies an approximately equal thickness of rhyolitic to dacitic flows and tuffs. At the base of the section occurs a distinctly different and thinner (about 50 m thick) sequence of flows, tuffs, and volcaniclastic sediments that is more nearly intermediate in average composition. In the northwest part of the area a Pb-Zn mine is found within a ridge of Lower Cretaceous limestone and shale that was intruded by a granitic stock. With the exception of thick ash-flow sheets, most units are localized and lenticular, precluding correlation of volcanic units between ranges. No large calderas were found although volcanic vents are suspected in several areas. Dissert. Abstr.

N84-23067 State Univ. of New York, Albany.
STRUCTURE OF THE BREVARD ZONE AND BLUE RIDGE NEAR LENOIR, NORTH CAROLINA, WITH OBSERVATIONS ON OBLIQUE CRENULATION CLEAVAGE AND A PRELIMINARY THEORY FOR IRROTATIONAL STRUCTURES IN SHEAR ZONES Ph.D. Thesis
Andy Russell Bobyarchick 1983 360 p
Avail: Univ. Microfilms Order No. DA8401429

Stratigraphy on the eastern flank of the Southern Appalachian Blue Ridge near the Grandfather Mountain window is arranged in a series of fault-bounded lithotectonic belts stacked so that the structural section dips steeply southeast. The Fries block of the Blue Ridge thrust sheet overlies the Grandfather Mountain window along the Linville Falls fault. The Laytown belt overlies the Fries block along the Winding Stairs Mountain fault. The Brevard zone, bounded as its base by the Ripshin Mountain fault and bounded as its top by the Yadkin fault, lies on the Laytown belt. Theoretical models for irrotational structures in two-dimensional plane strain demonstrate that: lines of material particles lying in an oblique irrotational orientation make an angle, alpha, with the shear zone boundaries whose vertex indicates the shear sense for the simple shear component and the oblique irrotational direction could experience a component of simple shear equal in sign to that of the shear zone. Dissert. Abstr.

N84-23068 California Univ., San Diego.
DEPOSITIONAL HISTORY AND STRUCTURAL EVOLUTION OF A SEDIMENTARY BASIN IN A MODERN FOREARC SETTING, WESTERN SUNDA ARC, INDONESIA Ph.D. Thesis
Desiree Beaudry 1983 168 p
Avail: Univ. Microfilms Order No. DA8400001

A three-dimensional stratigraphic framework of the forearc basin of west Sumatra was established using seismic-stratigraphic interpretation techniques. The major problems investigated are: (1) spatial and temporal patterns of sedimentation; (2) depositional processes and environments; (3) structural style and forearc stress state; and (4) Cenozoic evolution of arc-trench system. The data show that subaerial erosion occurred across the shelf following a period of tectonism and prior to regional subsidence. This mid-Tertiary change produced a regional angular unconformity which is constrained to late Oligocene time. The unconformity represents an important change in tectonic and sedimentary style attributed to major changes in rates and directions of subduction in this region. Erosion was enhanced by a worldwide lowering of sea level. During Miocene time, subsidence and transgression of the shelf created a shallow-water marine environment of deposition. Author

N84-23465*# Geological Survey, Flagstaff, Ariz.
IMPACT OF UPHEAVAL DOME, UTAH
E. M. Shoemaker and K. E. Herkenhoff (California Inst. of Tech., Pasadena) *In* NASA. Washington Rept. of Planetary Geol. Program, 1983 Apr. 1984 p 93 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 08G

N84-23475*# State Univ. of New York, Buffalo. Dept. of Geological Sciences.
EAST BUTTE: A VOLCANIC DOME OF THE EASTERN SNAKE RIVER PLAIN, IDAHO
John E. Bretches and John S. King *In* NASA, Washington Rept. of Planetary Geol. Program, 1983 1984 p 121-124 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 08G

N84-23476*# New Mexico Univ., Albuquerque. Dept. of Geology.

CHRONOLOGY, MORPHOLOGY AND STRATIGRAPHY OF PUMICEOUS PYROCLASTIC-FLOW (IGNIMBRITE) DEPOSITS FROM THE ERUPTION OF MOUNT ST. HELENS ON 18 MAY 1983
C. William Criswell and Wolfgang E. Elston *In* NASA. Washington Rept. of Planetary Geol. Program, 1983 Apr. 1984 p 125-126 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 08G

N84-23477*# New Mexico Univ., Albuquerque. Dept. of Geology.
CLASSIFICATION OF VOLCANOES OF THE KANE PATERA QUADRANGLE OF IO: PROPORTIONS OF LAVA FLOWS AND PYROCLASTIC FLOWS
Wolfgang E. Elston *In* NASA, Washington Rept. of Planetary Geol. Program, 1983 Apr. 1984 p 127-129 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 08K

N84-23478*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DISTRIBUTION AND PROPERTIES OF SMALL VOLCANOES IN ACIDALIA PLANITIA
Herbert Frey and Ann Semeniuk *In* NASA. Washington Rept. of Planetary Geol. Program, 1983 Apr. 1984 p 130-132 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 08K

N84-23479*# Arizona State Univ., Tempe. Dept. of Geology.
THE 1950 SULFUR FLOW OF MAUNA LOA: CONSIDERATIONS FOR IO
Ronald Greeley, Eilene Theilig, and Philip Christensen *In* NASA. Washington Rept. of Planetary Geol. Program, 1983 Apr. 1984 p 133-134 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 08K

N84-23480*# Geological Survey, Flagstaff, Ariz.
VOLCANISM IN THE VALLES MARINERIS
Baerbel K. Lucchitta *In* NASA. Washington Rept. of Planetary Geol. Program, 1983 Apr. 1984 p 135-137 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 08K

N84-23482*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
EFFUSION RATE, LENGTH, AND AREA RELATIONSHIPS FOR SOME LAVA FLOWS ON HAWAII AND MOUNT ETNA WITH PLANETARY IMPLICATIONS
David Pieri and Stephen Baloga (DOE, Washington, D.C.) *In* NASA. Washington Rept. of Planetary Geol. Program, 1983 Apr. 1984 p 141-143 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 08K

N84-23483*# Arizona State Univ., Tempe.
EXPERIMENTS ON WATER/MELT EXPLOSIONS, NATURE OF PRODUCTS, AND MODELS OF DISPERSAL
Michael F. Sheridan and Kenneth H. Wohletz (LASL) *In* NASA. Washington Rept. of Planetary Geol. Program, 1983 Apr. 1984 p 144-146 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 08G

N84-23484*# Arizona State Univ., Tempe. Dept. of Geology.
RIDGES ON BASALT FLOWS
Eilene Theilig *In* NASA. Washington Rept. of Planetary Geol. Program, 1983 Apr. 1984 p 147-148 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 08G

N84-23492*# Arizona State Univ., Tempe. Dept. of Geology.
DESERT PAVEMENT STUDY AT AMBOY, CALIFORNIA
Steven Williams and Ronald Greeley *In* NASA. Washington Rept. of Planetary Geol. Programs Apr. 1984 p 169-170 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 08G

N84-23493*# Michigan Univ., Flint. Dept. of Research and Community Science.
WIND EROSION AND DUNE FORMATION ON HIGH FROZEN BLUFFS Abstract Only
W. M. Marsh and B. D. Marsh, (Johns Hopkins Univ., Baltimore) *In* NASA. Washington Rept. of Planetary Geol. Programs Apr. 1984 p 171 (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 08G

N84-23494*# Arizona Univ., Tucson. Dept. of Geosciences.
FLUVIAL EROSION OF IMPACT CRATERS: EARTH AND MARS
Victor R. Baker *In* NASA. Washington Rept. of Planetary Geol. Programs Apr. 1984 p 175-177 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 08G

N84-23495*# Geological Survey, Vancouver, Wash.
THE 19 MARCH 1982 ERUPTION AND LAHAR AT MOUNT SAINT HELENS: IMPLICATIONS FOR MARTIAN OUTLFOW CHANNELS? Abstract Only
Gary L. Beach *In* NASA. Washington Rept. of Planetary Geol. Programs Apr. 1984 p 178 (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 08K

N84-23496*# Geological Survey, Vancouver, Wash.
DRAINAGE EVOLUTION IN THE DEBRIS AVALANCHE DEPOSITS NEAR MOUNT SAINT HELENS, WASHINGTON
Gary L. Beach and Dan Dzurisin *In* NASA. Washington Rept. of Planetary Geol. Programs Apr. 1984 p 179-181 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 08K

N84-23500*# Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
QUANTITATIVE AND EXPERIMENTAL MODELLING OF SAPPING NETWORKS
Alan D. Howard and Craig Kochel *In* NASA. Washington Rept. of Planetary Geol. Programs Apr. 1984 p 191-193 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 08H

N84-23501*# Arizona State Univ., Tempe. Dept. of Geology.
PLANETARY GEOMORPHOLOGY FIELD STUDIES: WASHINGTON AND ALASKA
Michael C. Malin *In* NASA. Washington Rept. of Planetary Geol. Programs Apr. 1984 p 194-195 *ref* (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 08G

N84-23502*# New Mexico Univ., Albuquerque. Dept. of Geology.
A REGRESSION MODEL FOR THE TEMPORAL DEVELOPMENT OF SOIL PIPES AND ASSOCIATED GULLIES IN THE ALLUVIAL-FILL VALLEY OF THE RIO PUERCO, CENTRAL NEW MEXICO
Christopher D. Condit and Wolfgang E. Elston *In* NASA. Washington Rept. of Planetary Geol. Programs Apr. 1984 p 196-197 (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 08H

N84-23510*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SALTS IN THE DRY VALLEYS OF ANTARTICA
E. K. Gibson, Jr., B. J. Presley (Texas A&M Univ.), and J. Hatfield (Utah State Univ.) *In* NASA. Washington Repts. of Planetary Geol. Program Apr. 1984 p 219-221 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 08G

N84-23514*# Arizona State Univ., Tempe. Dept. of Geology.
PLANETARY GEOMORPHOLOGY FIELD STUDIES: ICELAND AND ANTARCTICA
Michael C. Malin *In* NASA. Washington Rept. of Planetary

Geology Program, 1983 Apr. 1984 p 231-233 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 08G

N84-23517*# Whittier Coll., Calif. Dept. of Geology.
TEMPORAL AND SPATIAL DISTRIBUTION OF EXHUMED TOPOGRAPHY
Dallas D. Rhodes *In* NASA. Washington Rept. of Planetary Geology Program, 1983 Apr. 1984 p 240-242 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 08G

N84-23533*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
MERCURY: TOPOGRAPHIC AND GEOLOGIC DATA FROM EARTH-BASED RADAR OBSERVATIONS
M. E. Strobell (Geological Survey, Flagstaff, Ariz.), P. E. Clark (Murray State Univ., Ky.), G. G. Schaber (Geological Survey, Flagstaff, Ariz.), R. F. Jurgens, and G. S. Downs *In* NASA, Washington Rept. of Planetary Geology Program, 1983 Apr. 1984 p 287 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 08G

N84-23540*# Massachusetts Univ., Amherst. Dept. of Geology and Geography.
INTERPRETATION OF PLANETARY STRESS SYSTEMS: DETERMINATION OF TECTONIC OVER-PRINTING IN NORTHWEST WYOMING
Donald U. Wise and M. Lee Allison *In* NASA. Washington Rept. of Planetary Geology Program, 1983 Apr. 1984 p 307-309 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 08G

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N84-23069 Michigan Univ., Ann Arbor.
ESTIMATING MONTHLY RAINFALL FROM GEOSTATIONARY SATELLITE IMAGERY OVER AMAZONIA, BRAZIL Ph.D. Thesis
Elen Maria Camara Cutrim 1983 122 p
Avail: Univ. Microfilms Order No. DA8402263

The infrared regression and the grid history satellite rainfall estimating techniques were utilized to estimate monthly rainfall in Amazonia during one month of the rainy season (March, 1980) and one month of the dry season (September, 1980). The estimates were based on 3 hourly SMS-II infrared and visible images. Three sets of coefficients for the grid history method (Marajo, Arabian Sea, and GATE) were used to estimate rainfall. The estimated rain was compared with gauge measurements over the region. The infrared regression technique overestimated by a factor of 1.5. The Marajo coefficients yielded the best estimate, especially for eastern Amazonia. In the wet month Marajo coefficients overestimated rain by 10% and in the dry month by 70%. The Arabian Sea coefficients overestimated rain and the GATE coefficients slightly underestimated rain for Amazonia. Two maps of monthly rainfall over Amazonia were constructed for March and September, 1980, combining the ground station and satellite infrared rainfall of the grid history method using the Marajo coefficients. Dissert. Abstr.

N84-23070 British Aerospace Dynamics Group, Bristol (England).
CORRELATION BETWEEN THE METEOROLOGICAL PARAMETERS AND THE OPTICAL STRENGTH OF ATMOSPHERIC TURBULENCE CLOSE TO THE GROUND. PART 3: RESULTS
G. E. Titmuss 13 Dec. 1980 53 p refs
(BAe-BT-10771) Avail: Issuing Activity

Optical probe separations to use at each of the different probe heights were determined. It is found that to remain within the bounds of the inertial subrange, separation should not exceed a distance equivalent to the height of the probes above the ground. If this is too restrictive, very much larger separations can be used if the correlation function remains nonzero. Data remaining within the inertial subrange agree remarkably well with the theoretical predictions based on this concept. The relationship between atmospheric refractive index structure (ARIS) and height is quite well defined down to within 15 cms of the ground; below this the trend becomes erratic. No simple relationship between the measured values of ARIS and the standard meteorological parameters is found. Author (ESA)

N84-23071*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A STATISTICAL EVALUATION AND COMPARISON OF VISSR ATMOSPHERIC SOUNDER (VAS) DATA AND CORRESPONDING RAWINSONDE MEASUREMENTS
Apr. 1984 17 p refs
(NASA-TM-82575; NAS 1.15:82575) Avail: NTIS HC A02/MF A01 CSCL 04B

Three mesoscale sounding data sets from the VISSR Atmospheric Sounder (VAS) produced using different retrieval techniques were evaluated of corresponding ground truth rawinsonde data for 6-7 March 1982. Mean, standard deviations, and RMS differences between the satellite and rawinsonde parameters were calculated over gridded fields in central Texas and Oklahoma. Large differences exist between each satellite data set and the ground truth data. Biases in the satellite temperature and moisture profiles seem extremely dependent upon the three dimensional structure of the atmosphere and range from 1 deg to 3 deg C for temperature and 3 deg to 6 deg C for dewpoint temperature. Atmospheric gradients of basic and derived parameters determined from the VAS data sets produced an adequate representation of the mesoscale environment but their magnitudes were often reduced by 30 to 50%. E.A.K.

N84-23072# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
INFLUENCE OF EXTRATROPICAL HETEOROLOGICAL PHENOMENON ON THE NORTHEAST BRAZILIAN CLIMATE: A STUDY USING FINITE ELEMENTS [INFLUENCIA DE FENOMENOS METEOROLOGICOS EXTRATROPICAIS NO CLIMA DO NORDESTE BRASILEIRO: UN ESTUDO VIA DIFERENCAS FINITAS]
Julio Buchmann, A. D. Moura, and M. H. Hirata Oct. 1983 19 p refs In PORTUGUESE; ENGLISH summary
(INPE-2912-PRE/425) Avail: NTIS HC A02/MF A01

The occurence of drought and rain anomalies in the Northeast Brazil, which could be caused by variations in the synoptic pressure systems located at middle and high latitudes of the Northern Hemisphere, through the mechanism of lateral forcing were studied. A two layer primitive equations model was used to simulate the coupling mechanism between tropics and extratropics. The northern boundary condition in the Northern Hemisphere used is a basic state plus the largest stationary perturbation which amplitude was obtained through a Fourier analysis of the u and v-velocities. A solution, confined to the equatorial region, was obtained after 5-6 days of integration. A probable interaction between the middle latitude flows and the tropics are shown. In the rainy (dry) case a convergence was obtained at 750 mb level, respectively more (less) to the west relative to the north coast of the Northeast region. At the 500 mb level vertical motions were observed more (less) intense near the Northeast coast and the northern part of the region for the rainy (dry) case. E.A.K.

N84-23073*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
APPLICATION OF VISSR ATMOSPHERIC SOUNDER (VAS) DATA
Gary J. Jedlovec Apr. 1984 17 p refs
(NASA-TM-82574; NAS 1.15:82574) Avail: NTIS HC A02/MF A01 CSCL 04B

Sounding data which were derived from VAS radiance measurements and anticipated increased time and space resolution of the mesoscale environment are outlined. The new data presents

problems which are not encounted when using conventional measurements because of the irregular spacing of the data, biases in the data, and errors due to cloud contaminated measurements. These problems are addressed and an analysis technique which utilizes LFM guess fields to produce a consistent four dimensional data set which describes the mesoscale environment over a large area is presented. E.A.K.

N84-23074# Transportation Systems Center, Cambridge, Mass.
AWOS (AUTOMATIC WEATHER OBSERVING SYSTEM) SENSOR EVALUATION. TRANSMISSOMETER, FORWARD-SCATTER METER AND LIDAR CEILOMETER Final Report, Aug. 1980 - Jul. 1982
D. C. Burnham and D.F.. Jr. Collins Jan. 1984 213 p
(AD-A138743; DOT-TSC-FAA-82-6; DOT/FAA/PM-83/20) Avail: NTIS HC A10/MF A01 CSCL 04/2

Ceiling and visibility measurements are included in an Automatic Weather Observing System (AWOS) which is intended to satisfy the needs of aviation. The performance of one ceilometer and two visibility sensors was examined to determine whether they can meet the requirements of AWOS systems. The visibility sensors employed two different principles of operation: a transmissometer and a forward-scatter meter. The sensors were field tested at Arcata CA, Sterling VA, and Otis Air National Guard Base MA. During the last portion of the field testing the sensors were interfaced to a commercially available AWOS system to verify the sensor interfaces. The results of the evaluation indicate that the laser ceilometer and the transmissometer were generally satisfactory, but that the forward-scatter meter required additional development and testing because of electronic defects in the units tested. A major goal of the study was to develop and evaluate acceptance test procedures for AWOS ceilometers and visibility sensors. Accuracy and maintenance requirements, standard reference, sensors, and test methods were examined.
Author (GRA)

N84-23075# Weather Wing (1st), Hickam AFB, Hawaii.
A STUDY OF WESTERN NORTH PACIFIC TROPICAL STORMS AND TYPHOONS THAT INTENSIFY AFTER RECURVATURE
C. P. Guard 8 Nov. 1983 28 p Presented in part at the 12th Tech. Conf. on Hurricanes and Trop. Meteorol. of the Am. Meteorol. Soc., New Orleans, 24-27 April 1979
(AD-A138792; AD-E850548; Rept-1WW/TN-83/002) Avail: NTIS HC A03/MF A01 CSCL 04/2

Contrary to the indications of several past studies, numerous tropical cyclones, intensify after recurvature. The unexplained behavior has led to large intensity forecast errors. This study reveals two seasonal peaks of the behavior separated by a July minima in which intensification after recurvature (IAR) does not occur. A particular synoptic pattern is indentified. Monthly characteristics of IAR are explained as a function of physical parameters in the tropical cyclone's oceanic and atmospheric environment. Guidelines are provided to allow the forecaster to anticipate and react to IAR. GRA

N84-23076# Air Force Geophysics Lab., Hanscom AFB, Mass.
HANDBOOK OF GEOPHYSICS AND SPACE ENVIRONMENTS, CHAPTER 15, 1983 REVISION: ATMOSPHERIC TEMPERATURE, DENSITY AND PRESSURE
A. E. Cole, I. I. Gringorten, Y. Izumi, A. J. Kantor, and P. Tattelman 13 Jun. 1983 97 p
(AF Proj. 6670)
(AD-A138846; AFGL-TR-83-0155; AFGL-ERP-840) Avail: NTIS HC A05/MF A01 CSCL 04/2

Temperature, density, and pressure from the surface to 90 km, are discussed in this report. Information on seasonal and latitudinal variations, interlevel correlations, and variability with time are included. The information in this report will also be Chapter 15 of the 1983 'Handbook of Geophysics and Space Environments.' GRA

N84-23077# Argonne National Lab., Ill. Environmental Research Div.
UNTAPPED MIDWESTERN WIND ENERGY RESOURCE: NOCTURNAL LOW-LEVEL WIND MAXIMA
Paul Frenzen and Douglas L. Sisterson 1984 14 p refs Presented at the Recent Devel. in Elect. Utility Res. Conf., Chicago, 3 Apr. 1984
(Contract W-31-109-eng-38)
(DE84-006424; CONF-840469-1) Avail: NTIS HC A02/MF A01

It is demonstrated that the use of the seventh root power law profile for wind energy resource assessment underestimates wind power density aloft in the Midwest. Much of this error is caused by the failure of this simple relation to simulate the contributions of nocturnal wind maxima, a regional circulation which frequently forms above 100 m over extensive, flat terrain. This phenomenon is briefly described, and it is shown to contribute significant additional energy at the 50 m level during the summer and early fall, periods when midwestern wind energy assessments indicate a deficiency. It is also shown that increasing a wind system's tower height could gain significant additional energy by low level wind maxima. DOE

N84-23078# World Meteorological Organization, Geneva (Switzerland).
WORLD WEATHER WATCH: THE PLAN AND IMPLEMENTATION PROGRAM, 1984-1987
Jul. 1983 65 p Proc. of 9th World Meteorol. Congr., Geneva, May 1983 and 35th WMO Executive Council Session, Geneva, May - Jun. 1983
(WMO-617; ISBN-92-63-10617-7) Avail: NTIS MF A01; print copy available at WMO, Geneva

The World Weather Watch (WWW) global observing system, data processing system, and telecommunication system operations for 1984 to 1987 are outlined. The WWW plan seeks to provide WMO members with the basic meteorological and related environmental information needed to operate national meteorological services. Author (ESA)

N84-23079# Royal Netherlands Meteorological Inst., De Bilt. Centrale Weerdienst.
FORECASTING THE WINDSTORM OF 12 MAY 1983 (ACENSION DAY)
C. Floor and G. S. Forbes 1983 66 p refs In DUTCH; ENGLISH summary
(KNMI-TR-43) Avail: NTIS HC A04/MF A01

The windstorm of 12 May 1983 over the Netherlands and the damage caused are described. The depression that caused the storm was unusual, not only because of the high wind speeds but also because of its small scale and the sudden intensification of the wind field. For these reasons it was very difficult to make a correct wind forecast. Author (ESA)

N84-23080# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
STUDY OF WIND SCATTEROMETER ANTENNA FOR ERS-1. VOLUME 1: EXECUTIVE SUMMARY REPORT
H. M. Braun, C. Ch. Etzler, M. Haimerl, H. Raupp, R. Sippel, R. Wagner, M. Westphal, L. Pettersson (Research Institute of National Defence, Sweden), R. Petersson (Ericsson Radio Systems, Sweden), H. Magnusson (Ericsson Radio Systems, Sweden) et al Paris ESA 12 Sep. 1983 53 p 2 Vol.
(Contract ESA-4914/81/NL-PP(SC))
(Y/A-3380; ESA-CR(P)-1832-Vol-1) Avail: NTIS HC A04/MF A01

A printed circuit slotted waveguide metallized CFRP antenna is proposed for the ERS-1 (ESA) wind scatterometer. One foldable panel hinged at + or - Y side is recommended. The front is painted white, the back has multilayer insulation. In elevation it is possible to create a shaped lobe with 10 dB higher level at one end of a 30 deg lobe by detuning the coupling slots in a distributing waveguide feeding the radiating ones. Due to the very low losses associated with this kind of antenna, 0.5 dB of the achievable maximum gain is 32 dBi. A microstrip antenna is a feasible alternative if double linear polarization is reintroduced.
Author (ESA)

N84-23081# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
STUDY OF WINDSCATTEROMETER ANTENNA FOR ERS-1 Final Report
H. M. Braun, C. Ch. Etzler, M. Haimerl, H. Raupp, R. Sippel, R. Wagner, M. Westphal, L. Pettersson (Research Institute of National Defence, Sweden), R. Petersson (Ericsson Radio Systems, Sweden), H. Magnusson (Ericsson Radio Systems, Sweden) et al
Paris ESA 25 Apr. 1983 248 p refs 2 Vol.
(Contract ESA-4914/18/NL-PP(SC))
(MIX/A-3188; ESA-CR(P)-1832-Vol-2) Avail: NTIS HC A11/MF A01

A Wind sca Herometer antenna (WSA) for ERS-1 was studied. The wind scaHerometer is one of the active microwave instruments (am1) to which the synthetic aperture radar (SAR) also belongs. The antennas for these two instruments are lrge planar arrays with common technology. The status of the antenna requirements is treated s preliminary because of the difficulty to defne antenna requirements before an overall system solution was selected. This was obvious after the tradeoff study, showing a printed aircuit antenna was an optimal choice, when the double polarization requirement was changed to single polarization resulting in a choice of a slotted waveguide antenna. The premising results from the trade off study concerning the printed circuit antenna led to the breadboardng of three different microstrip test circuits. Author

N84-23082# GKSS-Forschungszentrum Geesthacht (West Germany). Inst. fuer Physik.
METEOROLOGICAL INVESTIGATIONS AT THE WIND TEST SITE PELLWORM
H.-T. Mengelkemp 1983 37 p refs Presented at 3rd Intern. Meeting of Test Stations for SWECS, Pellworm, West Germany, 3-4 May 1983
(GKSS-83-E-61; ISSN-0344-9629) Avail: NTIS HC A03/MF A01

Meteorological parameters were measured at two towers (10 and 45 m) on a wind energy conversion systems test site. Wind speeds and directions are shown for 1982. The determination of the two parameter Weibull distribution for the wind speed and its application to wind power estimation are described.
Author (ESA)

N84-23083# Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif.
WNDCOM: ESTIMATING SURFACE WINDS IN MOUNTAINOUS TERRAIN Final Report
Bill C. Ryan 1983 15 p ref
(PB84-157700; FSGTR-PSW-73) Avail: NTIS HC A02/MF A01 CSCL 04B

WNDCOM is a mathematical model for estimating surface winds in mountainous terrain. By following the procedures described, the sheltering and diverting effect of terrain, the individual components of the windflow, and the surface wind in remote mountainous areas can be estimated. Components include the contribution from the synoptic scale pressure gradient, the sea breeze, the slope wind, and the valley wind. For each component, a brief description, the data and information needed for estimation, and step-by-step procedures are provided. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N84-23084# Academy of Sciences (USSR), Moscow. Soviet Geophysical Comm.
SCIENTIFIC ACTIVITY IN OCEANOGRAPHY, 1979-1982
1983 21 p refs In RUSSIAN and ENGLISH Presented at the 18th Gen. Assembly of the International Union of Geodesy and Geophysics
Avail: NTIS HC A02/MF A01

The most important theoretical and experimental investigations of the physical and geographical problems of the World oceans, completed in the period 1979-1982 by different oceanological institutes of the USSR are reported. The bibliography contains publications (monographs, collected articles, atlases) and it is listed only in Russian. E.A.K.

N84-23085*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
TOPEX: OBSERVING THE OCEANS FROM SPACE
Jul. 1982 20 p refs
(NASA-CR-173490; JPL-400-133; NAS 1.26:173490) Avail: NTIS HC A02/MF A01 CSCL 08C

Measurement of global ocean topography by a radar altimeter aboard the TOPEX satellite is discussed. Technical aspects of satellite altimetry as they pertain to the measurement of ocean circulation are described. The TOPEX mission is explained and a general history of oceanography is included. M.A.C.

N84-23086# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
A ONE DIMENSIONAL MODEL FOR THE STUDY OF UPWELLING [UM MODELO NUMERICO UNIDIMENSIONAL PARA O ESTUDO DA RESSURGENCIA]
Claudio Solano Pereira and Msarco Antonio Maringolo Lemes Oct. 1983 42 p refs In PORTUGUESE; ENGLISH summary
(INPE-2936-RPE/445) Avail: NTIS HC A03/MF A01

This work presents a model for a wind-induced coastal circulation of a stratified and rotating ocean. A nonlinear, unidimensional model made up to two layers of incompressible fluids whose equations are given by finite-difference approximations is presented. The numerical integration of the model utilizes a semi-implicit scheme, where the pressure gradient, divergence and lateral diffusion terms are evaluated implicitly. A barocinic alongshore jet is found with a width comprable to the scale of the upwelling, i.e., approximately 30 km. About 10 days are taken for the initially 50 m deep pycnocline to surface. A secondary upwelling is observed when an idealized bottom topography is included in the model and in the neighborhood of the shelf break. In both cases, the offshore flow is the Eckman drift, with a downwelling regions where the curl of the wind stress is negative. Author

N84-23087# Royal Australian Navy Research Lab., Edgecliff.
COMPARISONS OF SEA-SURFACE TEMPERATURE OBTAINED FROM SHIP AND SATELLITE DATA
L. J. Hamilton Oct. 1983 57 p
(AD-A138257; AD-E750826; RANRL-TM(EXT)-8/83) Avail: NTIS HC A04/MF A01 CSCL 08/10

Sea-surface-temperatures (SST) obtained by thermosalinograph on five cruises during the period 23 September 1982 to 30 January 1983 in waters east and north-east of the Australian coastline are compared graphically with SST obtained from three sources of satellite data, GOSSTCOMP charts (Global Operational Sea Surface Temperature Computation), NWS charts (National Weather Service), and GMS (Geostationary Meteorological Satellite) tables. The data is plotted as temperatures versus cumulative ship distance travelled. For these cruises, fronts and features were seldom discernible in the satellite data but broad scale average trends were well shown. GOSSTCOMP was found to be the most reliable temperature indicator, often closely following the graph of highly smoothed ship temperature. NWS often tended to follow peak temperatures while GMS often overestimated SST by more than 3 C. Estimates are given on the usefulness of absolute values of satellite SST in real-time analyses. GRA

N84-23088# Naval Postgraduate School, Monterey, Calif.
THE EFFECT OF INTERIOR MOTION ON SEASONAL THERMOCLINE EVOLUTION M.S. Thesis
J. P. Garner Dec. 1983 86 p
(AD-A138270; AD-E950472) Avail: NTIS HC A05/MF A01 CSCL 08/3

The response of the seasonal thermocline formation and mixing to prescribed vertical interior motion is examined. For the annual and shorter period interior motion cases studied, the

response was strongest for the annual period. For an oscillatory vertical motion having a 15 m amplitude at a 75 m depth, warm sea surface temperature anomalies of up to 2.16 C and cold anomalies of up to 2.04 C are found, depending on the phase difference between the interior motion and the annual heat cycle. The net phase-averaged effect on the mixed layer for annual period interior motion is a reduction in vertical mixing. Higher frequency motion produces a net enhancement of the mixing. Author (GRA)

N84-23089# World Meteorological Organization, Geneva (Switzerland).
INTEGRATED GLOBAL OCEAN SERVICES SYSTEM (IGOSS): GUIDE TO THE IGOSS DATA PROCESSING AND SERVICES SYSTEM
1983 61 p refs Prepared in cooperation with Intergovernmental Oceanographic Commission
(WMO-623; ISBN-92-63-10623-1) Avail: NTIS MF A01; print copy available at WMO, Geneva SWFR 8

The Integrated Global Ocean Services System (IGOSS) for the global collection and exchange of oceanic data and the preparation and dissemination of oceanic data products and services is introduced. The IGOSS data processing and services system (IDPSS) requirements for products and services are outlined. Methods and techniques used for the preparation of oceanographic products, presentation of products, organization and procedures for data collection, quality control and dissemination, implementation of an IDPSS Program in a selected ocean area, and training and assistance available to developing member states are summarized. Author (ESA)

N84-23090# Institute of Oceanographic Sciences, Taunton (England).
WAVES RECORDED OFF THE EDDYSTONE LIGHTHOUSE. DATA FOR SEPTEMBER 1978 TO AUGUST 1981 AT POSITION 50 DEG 10 MIN N, 004 DEG 15 MIN W: SUMMARY ANALYSIS AND INTERPRETATION REPORT
B. C. H. Fortnum 1982 113 p refs Sponsored by Department of Energy and Department of Industry
(IOS-132) Avail: NTIS HC A06/MF A01

Wind and wave data recorded in the English Channel are presented. Monthly and yearly wind speed variations; wave heights; wave periods; persistence of calms and storms; and wave energy distributions are given. Author (ESA)

N84-23091 Howard Univ., Washington, D. C.
ATTITUDE AND SHAPE CONTROL OF LARGE SPACE STRUCTURES Ph.D. Thesis
Adapa Siva Sankara Rajeswara Reddy 1982 289 p
Avail: Univ. Microfilms Order No. DA8404050

The nonlinear equations of motion of flexible bodies such as free-free beams, plates and shallow spherical shells in circular orbits are taken as a basis to study the uncontrolled dynamics and to design the control systems to maintain the attitude and shape of large flexible space systems. The nonlinear equations of motion are linearized around nominal orientations, nominal motions and also nondimensionalized with respect to orbital period and characteristic dimensions of the structure. The point actuators that are utilized for control purposes are modelled and are incorporated into the linear dynamic models of the beams, plates and shells. As the mass and stiffness matrices that are encountered in modelling large space structures are very sparse, a graphical interpretation of the matrices and determinants are utilized to reduce the larger original state matrix in lower ordered sub matrices and then to evaluate the eigenvalues of the original matrix as a union of the eigenvalues of the sub matrices. Dissert. Abstr.

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N84-23092*# Star Enterprises, Bloomington, Ind.
BEHAVIORAL BIOLOGY OF MAMMALIAN REPRODUCTION AND DEVELOPMENT FOR A SPACE STATION Final Report
Jeffrey R. Alberts 1983 160 p
(Contract NASw-3745)
(NASA-CR-173493; NAS 1.26:173493) Avail: NTIS HC A08/MF A01 CSCL 06C

Space Station research includes two kinds of adaption to space: somatic (the adjustments made by an organism, within its lifetime, in response to local conditions), and transgenerational adaption (continuous exposure across sequential life cycles of genetic descendents). Transgenerational effects are akin to evolutionary process. Areas of a life Sciences Program in a space station address the questions of the behavioral biology of mammalian reproduction and development, using the Norway rat as the focus of experimentation. B.G.

N84-23093*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
MODULATED VOLTAGE METASTABLE IONIZATION DETECTOR Patent Application
Donald E. Humphry, inventor (to NASA) Filed 22 Feb. 1984 21 p
(NASA-Case-ARC-11503-1; US-Patent-Appl-SN-582643) Avail: NTIS HC A02/MF A01 CSCL 06B

Metastable ionization detectors used for chromatographic analysis usually employ a fixed high voltage for the ionization potential. For this reason, the operation range is limited to about three orders of magnitude. By use of the technique disclosed in the instant invention, operating ranges of about nine orders of magnitude are obtained. The output current from a metastable ionization detector is applied to a modulation voltage circuit. An adjustment is made to balance out the background current, and an output current, above background, is applied to an input of a strip chart recorder. For low level concentrations, i.e., low detected output current, the ionization potential will be at a maximum and the metastable ionization detector will operate at its most sensitive level. NASA

N84-23094# University of South Florida, St. Petersburg. Dept. of Marine Science.
THE BIOCHEMISTRY AND PHYSIOLOGY OF BACTERIAL ADHESION TO SURFACES Final Report, 15 Nov. 1982 - 15 Nov. 1983
J. H. Paul 20 Jan. 1984 53 p
(Contract N00014-83-K-0024)
(AD-A138271; AD-E950472) Avail: NTIS HC A04/MF A01 CSCL 06/13

The physiologic mechanisms involved in bacterial adhesion to inert surfaces have been investigated employing fouling isolates obtained from the Chesapeake Bay. Specifically, we have: (1) compared the physiologic activity of attached and free-living bacteria; (2) studied the effect of metabolic inhibitors on attachment to determine what physiologic processes were involved in adhesion; (3) investigated the type of material employed as the adhesive substance. We have developed two unique microfouling assays that employ the DNA-specific fluorochromes Hoechst 33528 and 33342. These two assays permit the sensitive and specific enumeration of attached populations of bacteria, and were used in the experiments described below. Actively growing cells from log-phase cultures of Vibrio proteolytica adhered in greater numbers than late stationary phase or mercuri chloride-killed cells. Cells that were starved by resuspension in nutrient-free medium became progressively less adhesive. GRA

52 AEROSPACE MEDICINE

Includes physiological factors; biological effects of radiation; and weightlessness.

N84-23095* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
METHOD OF MAKING AN ION BEAM SPUTTER-ETCHED

VENTRICULAR CATHETER FOR HYDROCEPHALUS SHUNT Patent
Bruce A. Banks, inventor (to NASA) Issued 21 Feb. 1984 8 p Filed 24 Nov. 1982 Division of Serial No. 272407, filed 10 Jun. 1981, Patent No. 4,377,169
(NASA-Case-LEW-13107-2; US-Patent-4,432,853; US-Patent-Appl-SN-444124; US-Patent-Class-204-192E; US-Patent-Class-156-643; US-Patent-Class-156-644; US-Patent-Class-156-668) Avail: US Patent and Trademark Office CSCL 06B

The centricular catheter comprises a multiplicity of inlet microtubules. Each microtubule has both a large opening at its inlet end and a multiplicity of microscopic openings along its lateral surfaces. The microtubules are perforated by an ion beam sputter etch technique. The holes are etched in each microtubule by directing an ion beam through an electro formed mesh mask producing perforations having diameters ranging from about 14 microns to about 150 microns. This structure assures a reliable means for shunting cerebrospinal fluid from the cerebral ventricles to selected areas of the body.
Official Gazette of the U.S. Patent and Trademark Office

N84-23096 British Aerospace Dynamics Group, Bristol (England). Human Factors and Vision Research Dept.
SOME COMPARISONS BETWEEN NVL AND ORACLE-BASED MRTD APPROACHES
I. Overington 20 Jan. 1981 8 p refs
(BAe-BT-11240) Avail: Issuing Activity

Severe limitations of MRTD visual modeling for overall assessment of thermal imager systems in practical acquisition tasks are discussed. Desire to retain the MRTD concept for routine system comparison arises from its simplicity and because many laboratories are geared up to carry out practical MRTD measurement, despite its defects in no-search, foveal interrogation tasks. The relative flexibility of the NVL-based and ORACLE-based computation of MRTL is considered. It is concluded that, where MRTD must be used, there are good reasons for using ORACLE-based predictions of MRTD rather than NVL-based computations. Author (ESA)

N84-23097# School of Aerospace Medicine, Brooks AFB, Tex.
YELLOW OPHTHALMIC FILTERS IN THE VISUAL ACQUISITION OF AIRCRAFT Final Report, Apr. - Jul. 1982
W. F. Provines, A. J. Rahe, M. G. Block, T. Pena, and T. J. Tredici Dec. 1983 17 p
(AF Proj. 7755)
(AD-A138536; USAFSAM-TR-83-46) Avail: NTIS HC A02/MF A01 CSCL 06/16

Twenty subjects made a total of 400 threshold visual acquisitions of T-38 aircraft approaching from 9 miles out. Half of the acquisitions were made with the subjects wearing yellow ophthalmic filters, and the other half without filters. The researchers found no overall statistically significant difference in acquisition performance due to the use of yellow filters. Author (GRA)

N84-23098# Miami Univ., Fla. Dept. of Anesthesiology.
MODELING OF INHALATION ADMINISTRATION OF VAPORS WITH CAPACITY LIMITED CLEARANCE Final Scientific Report, 30 Jun. 1981 - 31 Aug. 1983
V. Thomas 31 Aug. 1983 100 p
(Grant AF-AFOSR-0210-81; AF Proj. 2312)
(AD-A138847; AFOSR-84-0125TR) Avail: NTIS HC A05/MF A01 CSCL 06/20

The overall objective of the project was to design economical and informative testing of subacute and chronic toxicity of new volatile substances. The specific objectives were: (1) to prepare a mathematical model for simulation of uptake, distribution, and elimination of vapors with capacity-limited clearance; (2) to obtain experimental data supporting the model; (3) to study the factors affecting nonlinearity of clearance (concentration dependence, interference of inhalation of other vapors). The main accomplishments are: (1) A program for mathematical solution of a multicompartmental model for simulation of uptake, distribution, and elimination of vapors having a capacity limited elimination pathway was prepared for the Apple II Plus computer and tested by simulating a variety of trichloroethylene and halothane exposures. (2) Three methods for determination of metabolic clearance were tested: (a) systemic clearance was determined from the concentration differences in inhaled air and arterial blood; (b) intrinsic clearance in organs was determined from distribution of inhaled chemicals in the body during steady state; (c) intrinsic clearance by each metabolic pathway was determined from distribution and elimination of metabolites. (3) The retention of vapors of water soluble chemicals in trachea was determined and the significance of retention of chemicals in respiratory airways is discussed. GRA

N84-23099# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio. Human Engineering Div.
THE EFFECT OF HAZE ON AN OPERATOR'S VISUAL FIELD AND HIS TARGET DETECTION PERFORMANCE
William N. Kama, Louis V. Genco, Mary Ann H. Barbato (Systems Research Labs., Inc., Dayton, Ohio), and Martha D. Hausmann (Systems Research Labs., Inc., Dayton, Ohio) Nov. 1983 27 p
(Contract F33615-82-C-0511; AF Proj. 7184)
(AD-A138330; AFAMRL-TR-83-066) Avail: NTIS HC A03/MF A01 CSCL 06/16

A study was conducted to determine what type of relationship, if any, exists between the amount of haze emanating from a transparency and the percent of an operator's visual field that is 'lost'. The effect of this haze on his ability to perform a target detection task was also determined. Ten subjects performed a simple target detection task in which they were required to indicate when they could see a slowly moving, 1.0 minute of arc, 80% contrast target that traveled in 8 (0, 45, 90, 135, 180, 225, 270 or 314 degrees) different angular directions from the center of a background screen towards the periphery. The subjects performed this task while looking through haze test panels mounted at 90 deg, 63 deg or 45 deg to their line of sight and which when illuminated by a bright light source mounted at the center of the background screen resulted in haze conditions of 2%-3.5%, 5%-10%, 15%-26% or 25%-48%. A baseline condition in which no test panel was interposed between the subject, the task, and the bright light source was also administered. Subject performance was evaluated in terms of: (1) the distance the target had moved before being seen, and (2) the number of times that is was not detected. The results of this study indicated that as the percent of haze present in a transparency increased, the percent of an operator's background FOV that is occluded also increased but that the percent of targets detected decreased. GRA

N84-23100# Naval Health Research Center, San Diego, Calif.
COGNITIVE PERFORMANCE CHANGE DURING A 6-HOUR HIKE AT LOW TEMPERATURE IN SIMULATED RAIN, AT CONTROLLED WALKING RATES Final Report
D. J. Hord and R. Thompson Dec. 1983 16 p
(MR0-4101)
(AD-A138358; NAVHLTHRSCHC-83-32) Avail: NTIS HC A02/MF A01 CSCL 06/19

Much evidence supports the idea that cognitive performance decrements associated with cold exposure are attributable to the discomfort experienced rather than to direct physiological effects. Data obtained under laboratory conditions have led to the 'distraction' hypothesis of cold-related cognitive performance changes. To test the effects of wet-cold exposure on cognitive performance in a field situation, thirty volunteers each completed a 6-hr hike in ambient temperatures ranging from -1.5 to 9.5 degrees C Core temperature, skin temperature and oxygen consumption were monitored continuously. VO2 max, body surface, mean skinfold, height and weight were obtained prior to the hike. Cognitive performance was measured at 1 hr intervals and included the Baddeley Reasoning, Coding, Number Comparison, and Tapping tests. The results indicate that core temperature changes do not correlate with any of the cognitive performance changes. Furthermore, skin temperature change did not correlate with cognitive performance change. The 'distraction' hypothesis was therefore not supported. Based on anecdotal information obtained while running subjects, it is hypothesized that cognitive performance

changes in wet-cold are related to personality attributes associated with attention or coping ability. GRA

N84-23101# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
FACTORS AFFECTING HUMAN TOLERANCE TO SUSTAINED ACCELERATION Interim Report
L. Hrebien and E. Hendler 30 Nov. 1983 51 p
(AD-A138520; NADC-84021-60) Avail: NTIS HC A04/MF A01 CSCL 06/19

Six relaxed subjects were exposed on a centrifuge to increasing G pulses in order to determine their G tolerance. G protection was provided by supination and/or inflation of anti-G suit (AGS) bladders using a newly developed rapid response, servo controlled anti-G (SCAG) valve. Supination, alone or with the AGS, was most effective in increasing G tolerance. Increases in SCAG Valve outlet pressure were directly related to increases in G tolerance. Neither of two modes of SCAG valve operation caused any significant difference in G tolerance nor in assessment of AGS comfort. When protected by supination and the AGS, sufficiently increasing G onset times reduced G tolerance. Adverse comments and low ratings for AGS comfort followed exposure to most G pulses when the subjects were protected by high levels of AGS bladder pressure. Author (GRA)

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N84-23102 British Aerospace Dynamics Group, Bristol (England). Human Factors and Vision Research Dept.
A POTENTIALLY POWERFUL METHOD OF SIMPLE AUTOMATIC RECOGNITION EXHIBITING SCALE AND ORIENTATION INDEPENDANCE
I. Overington 20 Jan. 1981 13 p refs
(BAe-BT-11088) Avail: Issuing Activity

Preprocessing carried out by the human visual system is discussed, and a concept of progressive profile form recognition is proposed. It consists of sensing presence of a local bounded object, deducing its centroid, highlighting the profile, deducing the zones of maximum rate of change of profile orientation, registering radii and relative angles of corner vectors from the centroid as origin in cyclic order, deriving ratios of adjacent corner radii and difference angles for adjacent radii, bisecting angles between adjacent radii and comparing new vector radii to the vector radii to chords joining corners, registering new profile intersections as additional corners as necessary and continuing bisecting and comparing to whatever fidelity is required. For low level recognition it is rarely necessary to carry out more than one or two bisection stages. Author (ESA)

N84-23103 British Aerospace Dynamics Group, Bristol (England). Human Factors and Vision Research Dept.
SOME CONSIDERATIONS OF FORMS AND DISTRIBUTIONS OF RECEPTIVE FIELD UNITS IN EARLY VISUAL PROCESSING
I. Overington 20 Jan. 1981 14 p refs
(BAe-BT-11177) Avail: Issuing Activity

The existence of multiple parallel channels for local visual processing of sustained images by primates, and whether the visual system carries out Fourier analysis of images are discussed. An image processing scheme is proposed. Primary image formation is by an optical system with a spread function relatively broad compared with the sampling resolution of the following detector system. Parallel local interactive processing is by a group of concentric excitatory/inhibitory receptive fields of cylindrical form and of center/surround ratio 3:1. A broad exponential skirt exists for the largest receptive field unit. The resultant spatial frequency response has $< 10\%$ dips in local frequency response compared to a smooth contrast sensitivity type of function. There is no Fourier analysis except by inference for very local image components or for periodic texture. Relative constancy of form information irrespective of size occurs by progressive coarsening of receptive fields away from a central foveal region. Author (ESA)

N84-23104 British Aerospace Dynamics Group, Bristol (England). Human Factors and Vision Research Dept.
SOME OBSERVATIONS ON RELATIVE APPROACHES TO VISUAL ACQUISITION MODELLING
I. Overington 20 Jan. 1982 7 p refs
(BAe-BT-11241) Avail: Issuing Activity

The MRTD/Johnson and ORACLE/CYCLOPS visual models are assessed for comparison and specification of target recognition systems. It is concluded that a form of MRTD modeling, starting from either an NVL-based or ORACLE-based foundation, is adequate for routine comparison of existing systems. For systems specification a much more rigorous approach involving search and peripheral vision is necessary. Author (ESA)

N84-23105 British Aerospace Dynamics Group, Bristol (England).
DETECTION OF HORIZONTAL BARS AS A FUNCTION OF LENGTH, SEPARATION, ECCENTRICITY AND FREQUENCY OF TEMPORAL MODULATION: POSSIBLE APPLICATIONS TO HELICOPTER ACQUISITION
N. J. Puzey and L. K. B. Holman 30 Mar. 1981 22 p refs
(BAe-BT-11288). Avail: Issuing Activity

The effects of frequency of luminance modulation and retinal eccentricity in the horizontal and vertical axes on the contrast threshold for detection of one or two horizontal bars was studied using stimuli chosen to represent the rotor tips of an Mi-24 helicopter gunship at particular distances. The use of rotor tip flicker for detection was considered. Compared with stationary stimuli, contrast sensitivity of observers decreases when the stimulus is flickering, so in naked eye viewing rotor tip flicker does not aid helicopter acquisition. Typical rotor tip flicker frequency for an Mi-24 is 20 Hz, well away from the region in which human observers are most sensitive (5 to 10 Hz). Author (ESA)

N84-23106 British Aerospace Dynamics Group, Bristol (England). Human Factors Research Dept.
MODELLING OF VISUAL SEARCH PERFORMANCE
K. J. Cooke 18 Oct. 1983 25 p refs
(BAe-BT-14588) Avail: Issuing Activity

The ORACLE vision model was calibrated for search exercises against targets growing in size and contrast. Antitank modeling highlighted its limitations for static scenes. Computer modeling reliability for static targets was improved. Author (ESA)

N84-23107# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.
NEW TECHNIQUES FOR MEASURING SINGLE EVENT RELATED BRAIN POTENTIALS Final Report
C. D. McGillem and J. I. Aunon 15 Oct. 1983 86 p
(Grant AF-AFOSR-0152-80; AF Proj. 2313)
(AD-A138694; AFOSR-84-0127TR) Avail: NTIS HC A05/MF A01 CSCL 12/1

Methods for selecting features of evoked patented (EP) waveforms to improve classification accuracy are described. It is found that use of an exhaustive search procedure gives moderate improvement over forward sequential feature selection and stepwise linear discriminant analysis procedures. A new procedure for classification using a combination of temporal and spectral representations of the data is described. Experimental results are presented illustrating the effectiveness of time-varying filters for processing EP waveforms. It is shown by means of computer simulations that much greater noise reduction is obtained with time-varying filters than is possible by any of the more conventional procedures that utilize time-invariant filters. At the same time the underlying waveforms are preserved by the filtering process. Modifications of a computer controlled display system to give precise timing measurements are described. Data showing the reduction in latency variance of EP components are presented. Reductions in the standard deviations of about 20% were obtained.

Experimental measurements of EP waveforms using a Sternberg paradigm are described. Preliminary analysis of the results shows an apparent substructure in the P300 and a significant correlation of certain of the P300 components and reaction time.
Author (GRA)

N84-23108# Michigan Univ., Ann Arbor. Perception Lab.
DETECTION OF DOTTED FORMS IN A STRUCTURED VISUAL NOISE ENVIRONMENT
M. J. Young 1 Mar. 1984 56 p
(Contract N00014-81-C-0266)
(AD-A138853; PERLAB-3) Avail: NTIS HC A04/MF A01 CSCL 06/16

Five experiments are described which explore the human observer's ability to detect single dotted lines masked by other dotted lines. Stimuli are presented tachistoscopically on a computer controlled cathode ray tube. Results indicate that: Rotations of the stimuli, relative to the orientation of the noise lines, improve detection performance only if the rotations are made around the Z axis. Rotations around the Y axis fail to improve detection performance. The mechanism involved in the detection of dotted forms uses different strategies or algorithms depending upon the density of the noise mask. Orienting the stimulus and masking lines to other than the horizontal decreases detection performance. The results are discussed in the context of model incorporating a variable aperture attentional process. Author (GRA)

N84-23109# Perceptronics, Inc., Menlo Park, Calif. Knowledge Systems Branch.
ALTERNATIVE KNOWLEDGE ACQUISITION INTERFACE STRUCTURES Final Technical Report, Sep. 1982 - Sep. 1983
K. T. Wescourt and P. W. Thorndyke Orlando, Fla. Naval Training Equipment Center Dec. 1983 104 p
(Contract N61339-82-C-0151)
(AD-A139019; PPAFTR-1131-83-1; NAVTRAEQUIPC-82-C-0151-1) Avail: NTIS HC A06/MF A01 CSCL 05/9

This research developed a design concept for an interactive system to acquire domain knowledge form a training expert. Such a system would facilitate the development of knowledge-based instructional systems by directly eliciting and encoding from domain experts knowledge needed to deliver instruction. An analysis of the process by which knowledge-based systems are constructed indicates that the generality of a knowlege acquisition system must be limited by domain characteristics and by the architecture of the system it serves, and the non-sequential, interacting activities during system development constrain the potential role of automated knowledge acquisition aids. A feasible concept for knowledge acquistion technology, building on prior research in artificial intelligence, involves the notion of class-generic systems for a related set of domains with a fixed architecture and training capabilities. This concept is developed and discussed in the context of proposed Navy training systems for acquiring models of trainee performance during learning, rules of behavior for an automated opponent in a tactics trainer, and a knowledge base of facts to be subsequently presented to trainees for memorization. GRA

N84-23110# Oklahoma Univ., Norman. Decision Processes Lab.
ABILITY AND EXPERTISE IN ACT GENERATION Interim Report
P. D. Engelmann and C. F. Gettys 30 Sep. 1983 38 p
(Contract N00014-80-C-0639)
(AD-A137973; AD-E750824; TR-30-09-83) Avail: NTIS HC A03/MF A01 CSCL 05/10

Act generation is a process used by decision makers to create a set of possible actions that might solve a problem. Since previous research has shown college students to generate incomplete sets of possible actions in act generation, the sets of actions generated by experts were examined in the first of two experiments to see if they were more complete. In the first of the two experiments, graduate psychology students were given an act generation task on a subject at which they were expert. Verbal behavior was recorded to aid in the description of expert performance. In the second experiment the same graduate psychology students were given a task at which their expertise should be of little or no value and were compared to a group of undergraduates. Measures of act generation performance in both experiments included measures of quantity and quality of actions generated. Since excellent act generation performance of graduate psychology students was found in tasks at which they were either expert of non-expert, divergent intellectual ability was implicated as the source of their excellence. In conclusion, while high intellectual ability was shown to be valuable in generating a nearly exhaustive set of actions, the issue of the effect of expertise on act generation performance remains unsettled. GRA

N84-23111# Oklahoma Univ., Norman. Decision Processes Lab.
PROBLEM ANALYSIS AND DEFINITION IN ACT GENERATION Interim Report
C. F. Gettys, M. Kelley, R. M. Pliske, and J. W. Beckstead 8 Aug. 1983 49 p
(Contract N00014-80-C-0639)
(AD-A137978; TR-8-8-83) Avail: NTIS HC A03/MF A01 CSCL 05/10

Three experiments are reported which provide converging evidence suggesting that problem analysis and definition is an important component in generating actions that might solve a problem. Subjects in the first experiment were given two types of cues to help them create solutions to a typical shortage problem. Subjects were able to translate the generic cues into specific implementations as expected, but were relatively unsuccessful at extracting the generic 'kernels' from cues that were in the form of specific implementation and creating variations of these 'kernels'. The second experiment explored the 'incubation' phenomena by having subjects resume generating possible solutions to a problem one week after their initial attempt. It was found that problem reorganization rarely occurred between the first and second sessions, and that most of the ideas generated in the second session were elaborations or variations of first-session ideas. The third experiment examined the effects of explicit training in problem analysis and definition. Subjects who received this training showed an improved ability to generate examples of most of the generic solutions to the problem, and tended to generate more indirect solutions to the problem. GRA

N84-23112# Purdue Univ., Lafayette, Ind. Dept. of Psychological Sciences.
PERSONNEL TECHNOLOGY: PERFORMANCE APPRAISAL, A PROCESS APPROACH Final Report, 15 Jun. 1982 - 14 Aug. 1983
J. L. Barnes-Farrell and D. R. Ilgen Oct. 1983 15 p
(Contract N00014-82-K-0449; RR0-4208)
(AD-A138359; TR-83-5) Avail: NTIS HC A02/MF A01 CSCL 05/10

This report briefly outlines research performed under a contract awarded for investigating processes affecting the accuracy of performance appraisals. A general overview of the research is provided, followed by a listing of major topic areas investigated and reference to the research reports the describe the research in detail. An Appendix to the report lists the titles of the technical reports, presentations at professional meetings, and theses or dissertations that resulted from the research. Author (GRA)

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N84-23113* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
HEAT RESISTANT PROTECTIVE HAND COVERING Patent
Kenneth R. Sidman (Little (Arthur D.), Inc., Cambridge, Mass.)

and Irving J. Arons, inventors (to NASA) (Little (Arthur D.), Inc., Cambridge, Mass.) Issued 28 Feb. 1984 6 p Filed 30 Jun. 1982 Sponsored by NASA
(NASA-Case-MSC-20261-2; US-Patent-4,433,439; US-Patent-Appl-SN-393581; US-Patent-Class-2-161R; US-Patent-Class-2-167) Avail: US Patent and Trademark Office CSCL 06Q

The heat resistant, protective glove is made up of first and second shell sections which define a palm side and a backside, respectively. The first shell section is made of a twill wave fabric of a temperature-resistant aromatic polyamide fiber. The second shell section is made of a knitted fabric of a temperature-resistant aromatic polyamide fiber. The first and second shell sections are secured to one another, e.g., by sewing, to provide the desired glove configuration and an opening for insertion of the wearer's hand. The protective glove also includes a first liner section which is secured to and overlies the inner surface of the first shell section and is made of a felt fabric of a temperature-resistant aromatic polyamide fiber and has a flame resistant, elastomeric coating on the surface facing and overlying the inner surface of the first shell section.

Official Gazette of the U.S. Patent and Trademark Office

N84-23114 Michigan Univ., Ann Arbor.
ADAPTIVE CONTROL STRATEGIES FOR COMPUTER-CONTROLLED MANIPULATORS Ph.D. Thesis
Yung Jin Chung 1983 243 p Previously announced as A84-19063
Avail: Univ. Microfilms Order No. DA8402260

This paper focuses on the study of an adaptive control method based on the perturbation equations in the vicinity of of a desired trajectory. The highly coupled nonlinear dynamic equations of a manipulator are expanded in the vicinity of a preplanned joint trajectory to obtain the perturbation equations. These perturbation equations are then used to design a feedback control law about the desired trajectory. The torques for the joint actuators consist of nominal torques computed from the Newton-Euler equations of motion and the variational torques computed from the perturbation equations. Since the parameters in the perturbation equations are unknown and also slowly time-varying, a recursive least square identifiction scheme is used to perform on-line prameter identification. The parameters of the perturbation equations and the feedback gains of the controller are updated and adjusted in each sampling period successively to obtain the necessary control effort. This adaptive control strategy reduces the manipulator control problem from a nonlinear control to controlling a linear control system about a desired trajectory. Computer simulation studies of a three-jointed PUMA robot arm are performed on a VAX-11/780 computer to illustrate the performance of this adaptive control strategy. Author (IAA)

N84-23115 Elliott-Automation Space and Advanced Military Systems Ltd., Camberley (England).
HUMAN FACTORS ASPECTS OF C3 SYSTEMS
J. A. Hopkinson 1983 32 p Presented at IEE Colloq., Jun. 1983
(PP-119) Avail: Issuing Activity

The design of command, control and communication centers is discussed. User characteristics, working environment, tasks, hardware and software are considered. A bunker design composed of circular, vertically distributed cells is proposed.

Author (ESA)

N84-23116 British Aerospace Dynamics Group, Bristol (England).
NUMERIC KEYBOARD LAYOUT AND COMPUTER MENU SELECTION
J. L. Evans 10 Aug. 1981 43 p refs
(BAe-BT-11969) Avail: Issuing Activity

Keyboard layout effect on computer menu selection was studied by asking subjects to respond to randomly presented two-digit numbers by keying the appropriate stimulus digits. Six different keyboard layouts were compared. Results suggest that performance is fastest for the traditional adding machine layout, i.e., a 3x3+1 format with 7, 8, 9 in the top row. A second experiment examined the keying performance of subjects in a typical menu selection task. The experiment reveals no significant effects on performance of keyboard design. The number of items presented in a menu determines response times. Author (ESA)

N84-23117 British Aerospace Dynamics Group, Bristol (England). Human Factors Dept.
AN EXPERIMENTAL COMPARISON OF OPERATOR RESPONSES TO VOICE AND TONE SYSTEM WARNINGS
Ann Irving 7 Sep. 1981 35 p refs
(BAe-BT-12051) Avail: Issuing Activity

Differences in operator performance between tones and voiced warnings were studied using the commonly recommended maxima of 5 warning tones and the more extreme case of 10. Results suggest that there is little or no difference in accuracy of recall (in a low stress situation) between 5 and 10 tones but that operators make fewer errors with voiced warnings. Operators respond significantly quicker to voiced warnings than tones.

Author (ESA)

N84-23118 British Aerospace Dynamics Group, Bristol (England). Human Factors Research Dept.
BIBLIOGRAPHY ON DIRECT VOICE INPUT AND DIRECT VOICE OUTPUT
Ann Irving Dec. 1981 50 p refs
(BAe-BT-12363) Avail: Issuing Activity

Around 400 references on direct voice data input and output in man-computer interaction are listed. Author (ESA)

N84-23119*# Massachusetts Inst. of Tech., Cambridge. Space Systems Lab.
HUMAN FACTORS IN SPACE TELEPRESENCE
David L. Akin, Russell D. Howard, and Joseph S. Oliveria Oct. 1983 100 p refs
(Contract NASw-3797)
(NASA-CR-173420; NAS 1.26:173420) Avail: NTIS HC A05/MF A01 CSCL 05H

The problems of interfacing a human with a teleoperation system, for work in space are discussed. Much of the information presented here is the result of experience gained by the M.I.T. Space Systems Laboratory during the past two years of work on the ARAMIS (Automation, Robotics, and Machine Intelligence Systems) project. Many factors impact the design of the man-machine interface for a teleoperator. The effects of each are described in turn. An annotated bibliography gives the key references that were used. No conclusions are presented as a best design, since much depends on the particular application desired, and the relevant technology is swiftly changing. Author

N84-23120# Pennsylvania State Univ., University Park. Materials Research Lab.
SAFETY EYE PROTECTION THROUGH USE OF FAST ACTING OPTICAL SWITCHING Final Report, Aug. 1982 - Sep. 1983
R. Messier and R. E. Newnham Jan. 1984 50 p
(Contract DAAG46-82-K-0056)
(AD-A138582; AMMRC-TR-84-3) Avail: NTIS HC A03/MF A01 CSCL 20/6

Due to the increasing use of lasers in military applications, along with their high power levels and short pulse times, there is a critical need for fast acting optical switches to protect the vision of personnel. Such devices must be economical, suitable for use either in optical components (e.g., binoculars and windshields) or in eye glasses or goggles, be responsive to laser energies from the UV to the near IR, and not impair the performance of the personnel in their mission. At present there are no materials/systems which fulfill these requirements. As a first step in developing new materials and materials related devices which are capable of switching from optical densities of less than 1 to greater than about 5 in times of a microsecond or less a critical review was undertaken. The main findings of this study are that there are four materials types which have potential for improved fast acting optical switches: (1) ferroelectric liquid crystals; (2) organo-

metallic films containing charge transfer complexes, which undergo field-induced redox reaction, (3) inorganic electrochromic films which undergo insulator-semiconductor or insulator-metal transitions due to short range diffusion; and (4) inhomogeneous media in which the inhomogeneity is on the order to the wavelength of visible light. GRA

N84-23121# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
EFFECTS OF A NEGATIVE G STRAP ON RESTRAINT DYNAMICS AND HUMAN IMPACT RESPONSE
B. F. Hearon, J. W. Brinkley, D. M. Hudson, and W. J. Saylor Dec. 1983 373 p
(AF Proj. 7231)
(AD-A138642; AFAMRL-TR-83-083) Avail: NTIS HC A16/MF A01 CSCL 06/17

A test program to assess the influence of a negative G strap on restraint dynamics and human impact response was conducted. Research objectives were to evaluate the effects on human impact response of negative G strap incorporation into restraint systems; To evaluate human impact response in the PCU-15/P torso harness and lap belt configuration compared to such response in a conventional double shoulder strap and lap belt configuration, and to obtain human impact response data for use in present and future mathematical modeling efforts which are intended to predict human inertial response to impact. GRA

N84-23122# Office of Naval Research, London (England).
A SURVEY OF EUROPEAN ROBOTICS RESEARCH
S. Harmon 27 Jan. 1984 17 p
(AD-A138952; ONRL-R-4-84) Avail: NTIS HC A02/MF A01 CSCL 06/4

This report describes the results of a 1981 survey to gather information about European robotics research that might be tailored to meet the US Navy's needs. The objectives of the study were: to identify key research organizations and scientists, and to determine the nature of the research and technology. The survey covered Belgium, France, the UK, Italy, Switzerland, and the Federal Republic of Germany. Author (GRA)

N84-23123# Carnegie-Mellon Univ., Pittsburgh, Pa. Robotics Inst.
MACHINE VISION: THREE GENERATIONS OF COMMERCIAL SYSTEMS Interim Report
J. L. Crowley 25 Jan. 1984 40 p
(AD-A139037; CMU-RI-TR-84-1) Avail: NTIS HC A03/MF A01 CSCL 06/4

Since 1980, machine vision systems for industrial application have enjoyed a rapidly expanding market. The first generation machines are two-dimensional binary vision systems, patterned after the SRI Vision Module. These systems will soon be joined by a second generation, based on edges description techniques. Both the first and second generation systems are pattern recognition machines. Research in machine vision is leading towards vision systems that will be able to dynamically model the three-dimensional (3-D) surfaces in a scene. This research will lead to a third generation of vision systems which will provide a dramatic increase in capabilities over the first two generations. This article describes these three generations of vision systems. The algorithms, data structures, and hardware architecture are presented for binary vision systems and edge-based systems. A framework is presented for the research problems which must be solved before a commercial vision system can be produced based on dynamic 3-D Scene analysis techniques. Author (GRA)

N84-22849# Lockheed Electronics Co., Plainfield, N. J.
DEVELOPMENT OF A GENERALIZED HUMAN-MACHINE INTERFACE
R. E. Knox *In* MIT Proc. of the 6th MIT/ONR Workshop on C3 (Command, Control, and Commun.) Systems Dec. 1983 p 100-105
(For primary document see N84-22835 13-32)
(AD-P002888) Avail: NTIS HC A14/MF A01 CSCL 05/8

N84-22853# Decision Science Consortium, Inc., Falls Church, Va.
RESEARCH ON COGNITIVE COLLABORATION BETWEEN PERSONS AND COMPUTERS
M. S. Cohen *In* MIT Proc. of the 6th MIT/ONR Workshop on C3 (Command, Control, and Commun.) Systems Dec. 1983 p 122-128
(For primary document see N84-22835 13-32)
(Contracts N00014-82-C-0138; N00014-80-C-0046)
(AD-P002892) Avail: NTIS HC A14/MF A01 CSCL 05/8

N84-22854# Naval Ocean Systems Center, San Diego, Calif.
A MAN-MACHINE INTERFACE CONCEPT FOR A STATE-OF-ART, SHIPBOARD, COMMAND/CONTROL CONSOLE
G. A. Osga *In* MIT Proc. of the 6th MIT/ONR Workshop on C3 (Command, Control, and Commun.) Systems Dec. 1983 p 133-135
(For primary document see N84-22835 13-32)
(AD-P002894) Avail: NTIS HC A14/MF A01 CSCL 05/8

N84-23393# Joint Publications Research Service, Arlington, Va.
RESEARCH IN MAN-MACHINE INTERACTION DISCUSSED
D. Balagezyan *In its* USSR Rept.: Sci. and Technol. Policy (JPRS-UST-84-007) 28 Feb. 1984 p 64-66 Transl. into ENGLISH from Kommunist (USSR), 20 Sep. 1983 p 2 (For primary document see N84-23391 13-81)
Copyright. Avail: NTIS HC A05

55 PLANETARY BIOLOGY

Includes exobiology; and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.
For components see *33 Electronics and Electrical Engineering.*

N84-23124# Stanford Univ., Calif. Information Systems Lab.
DATA COMPRESSION Final Technical Report, 1 Sep. 1980 - 31 Jan. 1984
R. M. Gray 21 Feb. 1984 23 p
(Contract DAAG29-80-K-0073)
(AD-A138541; ARO-17372.7-EL) Avail: NTIS HC A02/MF A01 CSCL 09/2

The fundamental goal of this contract was to develop computer aided design algorithms for data compression systems and to study the performance and complexity of these systems via simulation and mathematical analysis. Since distortion is inevitable in compression systems, a design goal is to minimize the average distortion for a given communication or storage capacity or, equivalently, to minimize the communication or storage capacity subject to satisfactory data fidelity. This project was devoted to finding design algorithms which begin with a code of a fixed structure and then iteratively improve the code in the sense of producing codes with lower distortion and hence better fidelity.

The code structures are chosen to be implementable using current technology. The basic structure of all of the systems developed is well suited to VLSI implementation: a minimum distortion search algorithm on a chip communicating with off-board storage for codebooks and next-state transition functions.
Author (GRA)

N84-23125# Carnegie-Mellon Univ., Pittsburgh, Pa. Robotics Inst.
A HIGH SPEED PROCESSOR FOR BINARY IMAGES Interim Report
R. W. Berger Feb. 1984 16 p
(AD-A138908; CMU-RI-TR-84-2) Avail: NTIS HC A02/MF A01 CSCL 09/2

A video rate processor for binary images is described in this paper. The device convolves a binary image with a 3 level 64 by 64 mask. Images are processed at a rate of 10 million pixels per second, allowing real time processing of images obtained from a charged coupled device camera. Author (GRA)

N84-23126# Naval Aerospace Medical Research Lab., Pensacola, Fla.
THE USE OF A SMALL DIGITAL COMPUTER FOR ON-LINE BEHAVIORAL EXPERIMENTS
T. Griner, J. Knepton, and J. De Lorge 14 Dec. 1983 24 p
(F58-524)
(AD-A138975; NAMRL-1304) Avail: NTIS HC A02/MF A01 CSCL 05/10

Behavioral experiments solely relying on electromechanical and solid state devices for experiment control and data acquisition present special logistical problems and laborious data reduction tasks. Using small digital computers to control experiments and collect and analyze data allows multiple experiments to be conducted, and greatly enhances the speed and accuracy of data acquisition, reduction, and analysis. A digital Equipment Corporation PDP-8a minicomputer was satisfactorily used for a behavioral experiment to control the experiment, collect and process data, and retrieve data from the computer's storage area. GRA

N84-23226# Joint Publications Research Service, Arlington, Va.
FRENCH ONERA ACQUIRES U.S. SUPERCOMPUTER FOR RESEARCH
In its West Europe Rept.: Sci. and Technol. (JPRS-WST-84-011) 9 Apr. 1984 p 30 Transl. into ENGLISH from AFP Sci. (France), 26 Jan. 1984 p 11 (For primary document see N84-23224 13-70)
Avail: NTIS HC A03/MF A01

N84-23295# Air Force Space Div., Los Angeles, Calif.
THE MICROCOMPUTER IN THE ACQUISITION ENVIRONMENT Final Report
M. Ecung *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 5-11 (For primary document see N84-23293 13-81)
(AD-P002748) Avail: NTIS HC A24/MF A01 CSCL 15/5

N84-23331# Bedford Research Associates, Mass.
COMPUTER GENERATED ACQUISITION DOCUMENT SYSTEM (CGADS) Final Report
S. F. OShaughnessy and G. L. Roeder *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 209-213 (For primary document see N84-23293 13-81)
(AD-P002784) Avail: NTIS HC A24/MF A01 CSCL 15/5

N84-23332# American Inst. for Research, Bedford, Mass.
COMPUTER AIDED SOURCE SELECTION (CASS) Final Report
G. L. Roeder *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 214-216 (For primary document see N84-23293 13-81)
(AD-P002785) Avail: NTIS HC A24/MF A01 CSCL 15/5

N84-23390# Joint Publications Research Service, Arlington, Va.
COMPUTER DEVELOPMENTS AT INSTITUTE OF AUTOMATION AND ELECTROMETRY DESCRIBED
B. Konovalov *In its* USSR Rept.: Sci. and Technol. Policy (JPRS-UST-84-004) 23 Feb. 1984 p 45-49 Transl. into ENGLISH from Izv. (USSR), 17 Sep. 1983 p 2 (For primary document see N84-23387 13-81)
Copyright. Avail: NTIS HC A04

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N84-23127 Northwestern Univ., Evanston, Ill.
AN APPROACH TO CONTROL THE EVOLUTION OF SOFTWARE SYSTEMS Ph.D. Thesis
Robin Alexander Nicholl 1983 233 p
Avail: Univ. Microfilms Order No. DA8400712

It has become evident that software systems continue to evolve long after their initial development effort is complete. This phenomenon requires that software systems be maintained throughout the period in which they are in use. A primary problem of software maintenance is to identify which parts of a software system must be modified. A comprehensive model of software systems is discussed which may be used to describe the state of a software system after each phase of its development. More importantly, this model also describes the manner in which each phase of the software development process contributes to the realization of the system requirements in a particular implementation. Based on this model, procedures are given to permit identification of parts of a software system affected by a particular software modification. The model consists of a set of graph models, one to describe the end product of each phase of software development, and a set of graph rewriting systems, one to describe the refinement process carried out in each phase. Dissert. Abstr.

N84-23128 Maryland Univ., College Park.
ON THE GENERATION AND USE OF QUANTITATIVE CRITERIA FOR ASSESSING SOFTWARE MAINTENANCE QUALITY Ph.D. Thesis
Robert Stanley Arnold 1983 276 p
Avail: Univ. Microfilms Order No. DA8402525

Whenever software metrics are used in assessing the quality of software maintenance, their values must be interpreted relative to the metrics intended use. Further, these interpretations should lead to concrete suggestions for improving maintenance quality. This dissertation presents a method, Criteria Application (CA) for performing these interpretations and improvements. The principle feature of this method is the development of criteria for modeling software/maintenance quality concepts. A criterion is a testable condition, concerning software metrics' values, with an explicit judgment attached to the condition's outcome. The criteria are used in: (1) establishing goals for software maintenance, (2) quantitatively determining whether the goals are met, and (3) guiding remedial work if the goals are not met. Dissert. Abstr.

N84-23129* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOFTWARE ENGINEERING LABORATORY (SEL) DATA BASE REPORTING SOFTWARE USER'S GUIDE AND SYSTEM DESCRIPTION. VOLUME 1: INTRODUCTION AND USER'S GUIDE
Aug. 1983 282 p 2 Vol.
(NASA-TM-85608; SEL-82-003; NAS 1.15:85608) Avail: NTIS HC A13/MF A01 CSCL 09B

Reporting software programs provide formatted listings and summary reports of the Software Engineering Laboratory (SEL) data base contents. The operating procedures and system information for 18 different reporting software programs are described. Sample output reports from each program are provided. A.R.H.

N84-23130* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOFTWARE ENGINEERING LABORATORY (SEL) DATA BASE REPORTING SOFTWARE USER'S GUIDE AND SYSTEM DESCRIPTION. VOLUME 2: PROGRAM DESCRIPTIONS
Aug. 1983 239 p refs 2 Vol.
(NASA-TM-85609; SEL-82-003; NAS 1.15:85609) Avail: NTIS HC A11/MF A01 CSCL 09B

The structure and functions of each reporting software program for the Software Engineering Laboratory data base are described. Baseline diagrams, module descriptions, and listings of program generation files are included. A.R.H.

N84-23131 British Aerospace Dynamics Group, Bristol (England). Guidance and Control Dept.
A COMPUTER PROGRAM FOR THE EVALUATION OF CUBIC SPLINES
P. R. Michie 13 May 1981 28 p
(BAe-BT-11729) Avail: Issuing Activity

Spline functions are introduced and their application to a set of 10 data points and to obtain a trajectory is illustrated. A program to solve the spline equations is given. Author (ESA)

N84-23132 British Aerospace Dynamics Group, Bristol (England).
A GENERAL PURPOSE GUIDANCE SIMULATION PROGRAM: SOFTWARE DEFINITION
R. T. Saberi and P. J. Lewis 27 Apr. 1982 36 p
(BAe-BT-13122) Avail: Issuing Activity

A specification for a program with a modular structure for use as a general purpose modeling program is outlined. It provides a framework which controls the input, output, and storage of the model parameters. Program features include a preprocessor to check for unique variable names for the modules, change the name if required, and compile the user common blocks; and a four-pass run time system to ensure correct information flow between program modules. Author (ESA)

N84-23133# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
ORDERED ADDRESS BINARY TREES: A TECHNIQUE FOR THE OPTIMIZATION OF ACCESS TO TREES ON DISK [ARVORES BINARIAS COM ENDERECOS ORDENADOS: UMA TECNICA PARA OTIMIZACAO DE ACESSO PARA ARVORES EM DISCO]
Samuel Alves Pereira, Eliane Dippolito, and Hans Jurgen Seehusen Oct. 1983 14 p refs In PORTUGUESE; ENGLISH summary Presented at the 10th Seminario Integrado de Software e Hardward, Campinas, Brazil, 25-29 Jul. 1983
(INPE-2916-PRE/428) Avail: NTIS HC A02/MF A01

Binary trees are good methods for dynamic file organization. If a binary tree is stored on a pseudo random access store as a disk, it is possible to use the Ordered Address Binary Trees (OABT) technique for optimizing the mean number of accesses and transfers. The insertion and deletion algorithms to manipulate the OABT technique are presented. Simulation results indicate that the mean access number to OABT on disk can be reduced down to its half, compared to common binary trees. The virtual tree technique was used to maintain the balancing. R.J.F.

N84-23134*# Research and Data Systems, Inc., Lanham, Md.
USERS GUIDE FOR ERB 7 MAT (INCLUDING THE FIRST YEAR QUALITY CONTROL)
Brian Groveman Apr. 1984 114 p refs
(Contract NAS5-27728)
(NASA-CR-170514; NAS 1.26:170514) Avail: NTIS HC A06/MF A01 CSCL 09B

In the first section of this report background information for the use of the ERB-7 Master Archival Tapes (MAT) is provided. The second section gives details regarding the scientific validity and quality of the MAT. The MAT data analyzed covers the period from November 16, 1978 to October 31, 1979. Author

N84-23135*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GLOSSARY OF SOFTWARE ENGINEERING LABORATORY TERMS
Oct. 1983 41 p refs
(NASA-TM-85606; SEL-82-105; NAS 1.15:85606) Avail: NTIS HC A03/MF A01 CSCL 09B

A glossary of terms used in the Software Engineering Laboratory (SEL) is given. The terms are defined within the context of the software development environment for flight dynamics at the Goddard Space Flight Center. A concise reference for clarifying the language employed in SEL documents and data collection forms is given. Basic software engineering concepts are explained and standard definitions for use by SEL personnel are established. R.J.F.

N84-23136*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AN APPROACH TO SOFTWARE COST ESTIMATION
Frank McGarry, Jerry Page (Computer Science Corp.), David Card (Computer Science Corp.), Michael Rohleder (Computer Science Corp.), and Victor Church (Computer Science Corp.) Feb. 1984 74 p refs
(NASA-TM-85607; NAS 1.15:85607) Avail: NTIS HC A04/MF A01 CSCL 09B

A general procedure for software cost estimation in any environment is outlined. The basic concepts of work and effort estimation are explained, some popular resource estimation models are reviewed, and the accuracy of source estimates is discussed. A software cost prediction procedure based on the experiences of the Software Engineering Laboratory in the flight dynamics area and incorporating management expertise, cost models, and historical data is described. The sources of information and relevant parameters available during each phase of the software life cycle are identified. The methodology suggested incorporates these elements into a customized management tool for software cost prediction. Detailed guidelines for estimation in the flight dynamics environment developed using this methodology are presented. Author

N84-23137*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PROCEEDINGS OF THE EIGHTH ANNUAL SOFTWARE ENGINEERING WORKSHOP
30 Nov. 1983 326 p refs Workshop held in Greenbelt, Md., 3 Nov. 1983
(NASA-TM-85445; SEL-83-008; NAS 1.15:85445) Avail: NTIS HC A15/MF A01 CSCL 09B

The four major topics of discussion included: the NASA Software Engineering Laboratory, software testing, human factors in software engineering and software quality assessment. As in the past years, there were 12 position papers presented (3 for each topic) followed by questions and very heavy participation by the general audience. Author

N84-23138*# Maryland Univ., College Park.
CURRENT RESEARCH IN THE SOFTWARE ENGINEERING LABORATORY (SEL)
D. Card (Computer Sciences Corp.), Victor R. Basili, and M. Zelkowitz *In* NASA. Goddard Space Flight Center Proc. of the Eighth Ann. Software Eng. Workshop 30 Nov. 1983 18p refs
(For primary document see N84-23137 13-61)
Avail: NTIS HC A15/MF A01 CSCL 09B

The basic goal of software engineering is to produce the best possible software at the lowest possible cost. Many practices, tools, and techniques (collectively referred to as technologies) were developed that purport to help do this, some of which have become widely accepted in the software industry. However, few of these technologies were effectively evaluated experimentally. This is due in large part to an insufficient understanding of the software development process, a lack of recognized standards for measurement, and the prohibitive cost of large-scale controlled experiments. The analysis described addresses some of these issues. The

specific objectives of this study were to: measure technology use in a production environment; develop a model for evaluating software engineering technologies; and evaluate the effects of productivity and reliability of some specific technologies. Author

N84-23139*# Maryland Univ., College Park. Dept. of Computer Science.
MONITORING SOFTWARE DEVELOPMENT THROUGH DYNAMIC VARIABLES
Carl W. Doerflinger and Victor R. Basili *In* NASA. Goddard Space Flight Center Proc. of the Eighth Ann. Software Eng. Workshop 30 Nov. 1983 32p refs (For primary document see N84-23137 13-61)
(Grant NsG-5123)
Avail: NTIS HC A15/MF A01 CSCL 09B

Research conducted by the Software Engineering Laboratory (SEL) on the use of dynamic variables as a tool to monitor software development is described. Project independent measures which may be used in a management tool for monitoring software development are identified. Several FORTRAN projects with similar profiles are examined. The staff was experienced in developing these types of projects. The projects developed serve similar functions. Because these projects are similar some underlying relationships exist that are invariant between the projects. These relationships, once well defined, may be used to compare the development of different projects to determine whether they are evolving the same way previous projects in this environment evolved. Author

N84-23140*# Maryland Univ., College Park. Dept. of Computer Science.
CHARACTERISTICS OF A PROTOTYPE EXPERIMENT
Judin Sukri and Marvin V. Zelkowitz *In* NASA. Goddard Space Flight Center Proc. of the Eighth Ann. Software Eng. Workshop 30 Nov. 1983 22p refs (For primary document see N84-23137 13-61)
(Grant NAG5-368)
Avail: NTIS HC A15/MF A01 CSCL 09B

A new proposed software system was prototyped. Since the system, the Flight Dynamics Analysis System (FDAS), was to be a source code control system, and not the more typical flight dynamics software which NASA personnel were more familiar with, the decision was made to prototype an initial implementation in order to gain insights into the actual features needed to build a full FDAS and to evaluate the idea of prototype in NASA environment. The status of that project at the end of 1983 is described. Author

N84-23141*# Maryland Univ., College Park.
STRUCTURAL COVERAGE OF FUNCTIONAL TESTING
James Ramsey *In* NASA. Goddard Space Flight Center Proc. of the Eighth Ann. Software Eng. Workshop 30 Nov. 1983 10p refs (For primary document see N84-23137 13-61)
(Grant NsG-5123)
Avail: NTIS HC A15/MF A01 CSCL 09B

A FORTRAN program was instrumened to produce structural coverage measures. The structural coverage profiles of functionally generated acceptance tests and operational usage are used to examine two areas in software engineering: the examination of faults and the applicability of reliability models. Author

N84-23142*# Maryland Univ., College Park.
EXAMINING FUNCTIONAL ACCEPTANCE TESTING WITH STRUCTURAL COVERAGE METRICS
James Ramsey *In* NASA. Goddard Space Flight Center Proc. of the Eighth Ann. Software Eng. Workshop 30 Nov. 1983 14 p (For primary document see N84-23137 13-61)
Avail: NTIS HC A15/MF A01 CSCL 09B

Functionally generated acceptance tests are examined using structural coverage metrics. A method of comparing acceptance tests and operational usage was generated. Acceptance tests are prepresentative of operational usage except for the mix of statement types. Structural coverage metrics may provide insight into software faults. B.G.

N84-23143*# Syracuse Univ., N. Y. Dept. of Electrical and Computing Engineering.
AN ERROR-SPECIFIC APPROACH TO TESTING
Peter M. Valdes and Amrit L. Goel *In* NASA. Goddard Space Flight Center Proc. of the Eighth Ann. Software Eng. Workshop 30 Nov. 1983 22p (For primary document see N84-23137 13-61)
Avail: NTIS HC A15/MF A01 CSCL 09B

The main objective of software testing in the software development life cycle is to verify conformance of the implemented software with its intended requirements. Such requirements include system requirements, and programming requirements. Non-conformance with such requirements causes what are known as software errors. Specifying an appropriate testing strategy to expose software errors is still an art. Traditional approaches do succeed in revealing many errrors but none is powerful enough to expose all errors. The best that is hoped for is to use a specific test strategy to expose a specific error type in specific program locations. This limitation is exploited to develop a new approach to software testing which is called an error-specific testing (EST) strategy. Error specific testing is in fact a dual to the traditional testing approaches. Author

N84-23144*# Bell Telephone Labs., Inc., Holmdel, N. J.
TESTING AND ERROR ANALYSIS OF A REAL-TIME CONTROLLER
C. G. Savolaine *In* NASA. Goddard Space Flight Center Proc. of the Eighth Ann. Software Eng. Workshop 30 Nov. 1983 17p refs (For primary document see N84-23137 13-61)
Avail: NTIS HC A15/MF A01 CSCL 09B

Inexpensive ways to organize and conduct system testing that were used on a real-time satellite network control system are outlined. This system contains roughly 50,000 lines of executable source code developed by a team of eight people. For a small investment of staff, the system was thoroughly tested, including automated regression testing, before field release. Detailed records were kept for fourteen months, during which several versions of the system were written. A separate testing group was not established, but testing itself was structured apart from the development process. The errors found during testing are examined by frequency per subsystem by size and complexity as well as by type. The code was released to the user in March, 1983. To date, only a few minor problems found with the system during its pre-service testing and user acceptance has been good. Author

N84-23145*# Performance Measurement Associates, Inc., Vienna, Va.
TRANSFORMATIONS OF SOFTWARE DESIGN AND CODE MAY LEAD TO REDUCED ERRORS
Edward M. Connelly *In* NASA. Goddard Space Flight Center Proc. of the Eighth Ann. Software Eng. Workshop 30 Nov. 1983 p 18p refs Sponsored in part by Office of Naval Research (For primary document see N84-23137 13-61)
Avail: NTIS HC A15/MF A01 CSCL 09B

The capability of programmers and non-programmers to specify problem solutions by developing example-solutions and also for the programmers by writing computer programs was investigated; each method of specification was accomplished at various levels of problem complexity. The level of difficulty of each problem was reflected by the number of steps needed by the user to develop a solution. Machine processing of the user inputs permitted inferences to be developed about the algorithms required to solve a particular problem. The interactive feedback of processing results led users to a more precise definition of the desired solution. Two participant groups (programmers and bookkeepers/accountants) working with three levels of problem complexity and three levels of processor complexity were used. The experimental task employed required specification of a logic for solution of a Navy task force problem. Author

N84-23146*# Maryland Univ., College Park. Lab. for Human-Computer Interactions.
EVALUATING MULTIPLE COORDINATED WINDOWS FOR PROGRAMMING WORKSTATIONS
Ben Shneiderman, Charles Grantham, Kent Norman, Judd Rogers, and Nicholas Roussopoulos *In* NASA. Goddard Space Flight Center Proc. of the Eighth Ann. Software Eng. Workshop 30 Nov. 1983 11p refs Sponsored in part by IBM Federal Systems Div. (For primary document see N84-23137 13-61)
Avail: NTIS HC A15/MF A01 CSCL 09B

Programmers might benefit from larger screens with multiple windows or multiple screens, especially if convenient coordination among screens are arranged. Uses for multiple coordinated displays in a programmers workstation are explored. Initial efforts focus on the potential applications, a command language for coordinating the displays, and the psychological basis for effective utilization so as to avoid information overload. Subsequent efforts will be devoted to implementing the concepts and performing controlled psychologically oriented experiments to validate the hypotheses.
Author

N84-23147*# IBM Federal Systems Div., Houston, Texas.
CLEANROOM CERTIFICATION MODEL
P. A. Currit *In* NASA. Goddard Space Flight Center Proc. of the Eighth Ann. Software Eng. Workshop 30 Nov. 1983 12p (For primary document see N84-23137 13-61)
Avail: NTIS HC A15/MF A01 CSCL 09B

The Cleanroom software development methodology is designed to take the gamble out of product releases for both suppliers and receivers of the software. The ingredients of this procedure are a life cycle of executable product increments, representative statistical testing, and a standard estimate of the MTTF (Mean Time To Failure) of the product at the time of its release. A statistical approach to software product testing using randomly selected samples of test cases is considered. A statistical model is defined for the certification process which uses the timing data recorded during test. A reasonableness argument for this model is provided that uses previously published data on software product execution. Also included is a derivation of the certification model estimators and a comparison of the proposed least squares technique with the more commonly used maximum likelihood estimators.
Author

N84-23148*# IBM Federal Systems Div., Houston, Texas.
PROJECTING MANPOWER TO ATTAIN QUALITY
Kyle Y. Rone *In* NASA. Goddard Space Flight Center Proc. of the Eighth Ann. Software Eng. Workshop 30 Nov. 1983 55 p (For primary document see N84-23137 13-61)
Avail: NTIS HC A15/MF A01 CSCL 09B

The resulting model is useful as a projection tool but must be validated in order to be used as an on-going software cost engineering tool. A procedure is developed to facilitate the tracking of model projections and actual data to allow the model to be tuned. Finally, since the model must be used in an environment of overlapping development activities on a progression of software elements in development and maintenance, a manpower allocation model is developed for use in a steady state development/maintenance environment. In these days of soaring software costs it becomes increasingly important to properly manage a software development project. One element of the management task is the projection and tracking of manpower required to perform the task. In addition, since the total cost of the task is directly related to the initial quality built into the software, it becomes a necessity to project the development manpower in a way to attain that quality. An approach to projecting and tracking manpower with quality in mind is described.
Author

N84-23149*# IIT Research Inst., Rome, N.Y.
AN APPROACH TO SOFTWARE BASELINE GENERATION
Jorge Luis Romeu *In* NASA. Goddard Space Flight Center Proc. of the Eighth Ann. Software Eng. Workshop 30 Nov. 1983 27 p refs (For primary document see N84-23137 13-61)
Avail: NTIS HC A15/MF A01 CSCL 09B

A current Data & Analysis Center for Software (DACS) effort to develop software baselines is summarized. This baseline effort is an on-going activity; that is, the baselines are meant to be updated as new software data becomes available. The information presented and processed was organized to make periodic updating a much simpler task. A baseline, for this effort, consists of an estimation of any characteristic of a software project that is helpful to a developer, manager, or monitor to manage, control, or influence a software product. The objective of these baselines is to provide a tool for aiding software developers in their daily work. Baselines were synthesized from an empirical dataset provided by the Software Engineering Laboratory at NASA Goddard Space Flight Center (NASA/SEL). These data were selected because the data collection effort developed at the NASA/SEL is the most thorough and complete available.
Author

N84-23150*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MANAGERS HANDBOOK FOR SOFTWARE DEVELOPMENT
William Agresti, Frank McGarry, David Card, Jerry Page, Victor Church, and Roger Werking Apr. 1984 59 p refs
(NASA-TM-85604; SEL-84-001; NAS 1.15:85604) Avail: NTIS HC A04/MF A01 CSCL 09B

Methods and aids for the management of software development projects are presented. The recommendations are based on analyses and experiences with flight dynamics software development. The management aspects of organizing the project, producing a development plan, estimation costs, scheduling, staffing, preparing deliverable documents, using management tools, monitoring the project, conducting reviews, auditing, testing, and certifying are described.
M.A.C.

N84-23151# Command and Control Technical Center, Washington, D. C.
GENERALIZED MONITORING FACILITY. USERS MANUAL. CHANGE 7
1 Oct. 1983 269 p
(AD-A138533; CCTC-CSM-UM-246-82-Chg-7) Avail: NTIS HC A12/MF A01 CSCL 09/2

This users manual provides the information necessary for an individual to run all of the programs that are comprised in the Honeywell H6000 generalized monitoring facility. Program interrelationships are presented, as well as a general overview of the processing, input, and output procedures for each program. Formats and examples of user-controlled input data and sample program outputs are shown and explained, additionally, the job control language deck setups necessary to run the program are provided.
Author (GRA)

N84-23152# Naval Postgraduate School, Monterey, Calif.
DOCUMENTATION FOR SOFTWARE MAINTENANCE M.S. Thesis
J. F. Hall, II Dec. 1983 63 p
(AD-A138663) Avail: NTIS HC A04/MF A01 CSCL 09/2

Documentation as an effective method of transferring information between individuals in order to reduce software maintenance costs is examined. Various categories of documentation are identified and evaluated as to their effectiveness toward easing the maintenance effort. The concept of minimal documentation is introduced as the solution to the problem of determining the correct amount of information required for a specific maintenance task. The idea of utilizing an explicit documentation is proposed. With the proper implementation of the documentation hierarchy, the minimal documentation concept can be realized, and the maintenance effort reduced.
Author (GRA)

N84-23153# Army Tank-Automotive Command, Warren, Mich.
IMAGE ACQUISITION AND MANIPULATION SYSTEM
F. B. Hoogterp and S. A. Caito Jan. 1984 60 p
(AD-A138927; TACOM-TR-12907) Avail: NTIS HC A04/MF A01 CSCL 09/2

A complete image processing system has been developed on a Hewlett Packard (HP) 1000 series F computer. This system is

interfaced with a digital graphics CBX800 image frame grabber and display system. This report briefly describes the hardware interface required between the HP and the CBX. A more complete description is provided of the Image Processing Library. The Image Processing Library (developed explicitly for the system) consists of two levels. Interactive programs are included that provide a user with immediate access to standard image processing capabilities. Also, a FORTRAN callable library of image processing subroutines is described to speed the development of exploratory image processing algorithms. Author (GRA)

N84-23154# Massachusetts Inst. of Tech., Cambridge. Lab. for Informatio and Decision Systems.
IMPLEMENTATION OF AN OPTIMAL MULTICOMMODITY NETWORK FLOW ALGORITHM BASED ON GRADIENT PROJECTION AND A PATH FLOW FORMULATION
D. P. Bertsekas, B. Gendron, and W. K. Tsai Feb. 1984 66 p
(Contract N00014-75-C-1183; Grant NSF ECS-82-17668; ARPA Order 3045)
(AD-A138935; LIDS-P-1364) Avail: NTIS HC A04/MF A01 CSCL 05/2

The implementation of a multicommodity flow algorithm into a FORTRAN code is discussed. The algorithm is based on a gradient projection method with diagonal scaling based on Hessian or Jacobian information. The flows carried by the active paths of each origin-destination (OD) pair are iterated upon one OD pair, per iteration. The data structures and memory requirements of the algorithm are discussed and are compared with those of other formulation based on link flows associated with each origin, and aggregate link flows. Author (GRA)

N84-23155# California Univ., San Diego. Inst. for Cognitive Science.
SOFTWARE ENGINEERING FOR USER INTERFACES
S. W. Draper and D. A. Norman Jan. 1984 19 p
(Contract N00014-79-C-0323)
(AD-A138937; ICS-8401) Avail: NTIS HC A02/MF A01 CSCL 09/2

The discipline of Software Engineering can be extended in a natural way to deal with the issues raised by a systematic approach to the design of human-machine interfaces. Two main points are made: that the user should be treated as part of the system being designed, and that projects should be organized to take account of the current (small) state of a priori knowledge about how to design interfaces. Because the principles of good user-interface design are not yet well specified (and not yet known), interfaces should be developed through an iterative process. This means that it is essential to develop tools for evaluation and debugging of the interface, much the same ways as tools have been developed for the evaluation and debugging or program code. We need to develop methods of detecting bugs in the interface and of diagnosing their cause. The tools for testing interfaces should include measures of interface performance, acceptance tests, and benchmarks. Developing useful measures is a non-trivial task, but a start can and should be made. Author (GRA)

N84-23156# Army Construction Engineering Research Lab., Champaign, Ill.
USER MANUAL FOR DRIVER PROGRAM Final Report
B. Swain and D. Effland Jan. 1984 127 p
(AD-A139028; AD-E401136; CERL-TR-N-162) Avail: NTIS HC A07/MF A01 CSCL 09/2

NOISEMAP3.4 computer program efficiently computes the noise level of aircraft, which is one step in the determination of the noise impact created. DRIVER is a program that will simplify the use of NOISEMAP3.4 when evaluating simple rectangular flight patterns. This manual was designed to guide the reader in using the DRIVER program. DRIVER takes a more general description of the flight pattern and computes the necessary input for NOISEMAP3.4. This manual uses the helicopter training flight patterns as examples. Author (GRA)

N84-23157# Army Armament Research and Development Command, Aberdeen Proving Ground, Md. Chemical Systems Lab.
NONLINEAR LEAST-SQUARES FITTING OF FIRST-ORDER RATE COEFFICIENTS COMPARISON BETWEEN THE GAUSS-SEIDEL METHOD AND SWAIN'S KORE PROGRAM
J. W. Hovanec and J. R. Ward Jun. 1983 13 p
(DA Proj. 1L1-61101-A-71A)
(AD-A139080; ARCSL-TR-83057) Avail: NTIS HC A02/MF A01 CSCL 09/2

Swain and coworkers at MIT recently composed a 92-statement FORTRAN computer program to evaluate first-order rate coefficients from kinetic data. The program is called KORE (kinetic analysis using overrelaxation); the use of the overrelaxation factor accelerates the convergence of the calculation which Swain feels would be of advantage for any question fit with a least-squares method. To show the utility of the overrelaxation factor, Swain purposely used poor data to show that the KORE program converged while a much longer program by DeTar (LSKIN 1) did not converge. The authors have a general least-squares program based on the Gauss-Seidel method that was written in 1960 at Los Alamos Scientific Laboratory, and has been widely used in other Laboratories based on the number of citations in the Science Citation Index. It was thought that it might prove useful to see how this program handled the purposedly poor data Swain used to show the merit of the overrelaxation method. It was found that the Gauss-Seidel program converged unlike DeTar's program, so it is uncertain what advantage the overrelaxation factor contributes for the general least-squares method. Nevertheless, Swain's short program is still extremely useful for fitting first-order kinetic data which microcomputers, and Hovanec has adapted Swain's program in BASIC for the HP85 and APPLE II Plus computers. GRA

N84-23158# Centre de Recherches en Physique de l'Environnement, Issy-les-Moulineaux (France).
FAST EVALUATION OF THE NUMERICAL ERROR RATE IN THE PRESENCE OF INTERSYMBOLIC INTERFERENCE [EVALUATION RAPIDE DU TAUX D'ERREUR NUMERIQUE EN PRESENCE D'INTERFERENCE ENTRE SYMBOLES]
A. J. Levy Apr. 1983 50 p refs In FRENCH
(CRPE-NT-127) Avail: NTIS HC A03/MF A01

Methods used to compute the error probability in digital transmissions in the presence of noise and intersymbol interference are reviewed, and a method is deduced. This method is characterized by not using the moments of the intersymbol interference distribution, resulting in simplicity and low computing cost. A FORTRAN program applicable to amplitude and phase modulation is proposed. Author (ESA)

N84-23159# Hochschule der Bundeswehr, Munich. (West Germany). Fachbereich Luft- und Raumfahrttechnik.
CONTROL OF DYNAMIC SYSTEMS BASED ON GRAPHIC INFORMATION Ph.D. Thesis [STEUERUNG DYNAMISCHER SYSTEME AUFGRUND BILDHAFTER INFORMATIONEN]
Hans-Georg Meissner Aug. 1983 177 p refs In GERMAN
Avail: NTIS HC A09/MF A01

Approaches to motion control of dynamic systems based on visual information were developed and their usefulness was shown in experiments. The balancing of an inverted pendulum on an electric motor vehicle, and the control of a simulated vehicle are treated. A dynamic model of the process makes it possible to control a system with only a few graphic data. A television image sensor system recognizes simple patterns from which it obtains measurement data for the control computer. This makes it possible to control a real system exclusively with visual information. Special effects of motion interpretation are discussed. Author (ESA)

N84-23160# Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Computer Science.
A SURVEY OF THREE LANGUAGE-INDEPENDENT PROGRAMMING ENVIRONMENTS
Paul Klint Nov. 1983 35 p refs Submitted for publication
Sponsored by Institut National de Recherche en Informatique et Automatique

(MC-IW-240/83) Avail: NTIS HC A03/MF A01

The language-independent programming environments Mentor, Synthesizer Generator and CEYX are compared by constructing a programming environment for a toy language. The comparison shows that the systems are promising, but the definition of both concrete and abstract syntax leads to much duplication in the language specifications. The specification of dynamic semantics forms the weakest part of all three systems. Language-independent debugging, language-independent tools for flow analysis and general, language-independent, optimization techniques are required. None of the systems provides primitives for version control or project management nor do any of them support a particular, explicit, methodology for software development.

Author (ESA)

N84-23161# Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Computer Science.

AN N TO THE 1.618TH POWER LOWER BOUND ON THE TIME TO SIMULATE ONE QUEUE OR TWO PUSHDOWN STORES BY ONE TAPE

Paul M. B. Vitanyi Dec. 1983 8 p refs Submitted for publication

(MC-IW-245/83) Avail: NTIS HC A02/MF A01

Simulation of a pushdown by an oblivious one-head tape unit on-line which requires big omega n times sq root n time with Kolmogorov complexity arguments is considered. It is shown that big omega (n to the 1.618th power) lower bound of the simulation time is required for one queue, or two pushdown stores by a nonoblivious one-tape turing machine. Multitape machines can be simulated on-line by a one-head tape unit in square time. Square time is the best upper bound for the simulation of one queue or two pushdown stores by a one-head tape-unit. Author (ESA)

N84-23162 Missouri Univ., Columbia.

IMAGE COMPRESSION: A 2-DIMENSIONAL RUN-LENGTH CODING Ph.D. Thesis

I-Cheng Hsu 1983 132 p

Avail: Univ. Microfilms Order No. DA8401137

An efficient image compression technique was investigated with the goal of improving the management of a pictorial information system. A distortion-free data compression technique applicable to all types of images, including county maps, soil maps, line-drawing maps, LANDSAT images etc., in a pictorial database for redundancy removal was developed. A compression model associated with this technique was also developed to provide a systematic analysis of the operation and to be useful in predicting the compression performance for a class of images. There are three steps involved in this Edge Coded-Run Length (ECRL) compression algorithm. The three steps are edge encoding followed by orthogonal run-length encoding and finally by requantization, which make this technique efficient over a wide range of image types. The resulting coding scheme is perfectly reversible in terms of information content. Dissert. Abstr.

N84-22842# Mitre Corp., McLean, Va.

SOFTWARE FOR EXPLICITLY PROBABILISTIC MATHEMATICS

S. N. Goldstein *In* MIT Proc. of the 6th MIT/ONR Workshop on C3 (Command, Control, and Commun.) Systems Dec. 1983 p 48-57 (For primary document see N84-22835 13-32)

(AD-P002881) Avail: NTIS HC A14/MF A01 CSCL 09/2

62 COMPUTER SYSTEMS

Includes computer networks.

N84-23163 Northwestern Univ., Evanston, Ill.

THE REPRESENTATION AND SYNTHESIS OF DESIGN SPECIFICATIONS FOR DISTRIBUTED SOFTWARE SYSTEMS Ph.D. Thesis

Sol Mark Shatz 1983 168 p

Avail: Univ. Microfilms Order No. DA8400734

A design representation scheme and a compatible design synthesis approach for distributed software systems is presented. The represention scheme gives a formal method for specifying the communication among the software components. Petri nets are used as the specification medium and allow us to develop communication modules which represent various communication types such as common message broadcasting and synchronous selective receiving.A formal definition for communications modules is given, a number of specific communication modules are presented, and a set of simple rules concerning the construction of communication module specifications is established. A partitioning algorithm is used for clustering functional modules in order to derive a set of distributed processing components. The synthesis approach is oriented towards producing a software system which is reliable and maintainable and that exploits potential concurrency that exists between functional modules. Dissert. Abstr.

N84-23164# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.

EMPIRICAL ANALYSIS OF A TOKEN RING NETWORK

D. C. Feldmeier Jan. 1984 65 p

(Contract N00014-75-C-0661)

(AD-A138905; MIT/LCS/TM-254) Avail: NTIS HC A04/MF A01 CSCL 17/2

The purpose of this project was to do an empirical study of the performance, reliability and traffic patterns of the Laboratory for Computer Science version two local area network. Performance data allows the comparison of the version two ring specifically and token ring networks in general with other local area network strategies, such as the Ethernet, to discover which type of local area network is decidedly better and why. Traffic patterns indicate how computer networks are used. Performance analysis can be performed both theoretically and experimentally. Mathematical analysis of a local area network is complex and only roughly approximates the behavior of a network. Mathematical analysis is useful for determining which systems might be usable, but does not give enough information to choose among the different systems. Network data refines mathematical models for network evaluation. Improved mathematical models make evaluation and simulation of networks before construction more practical. Empirical analysis determines the performance of an network. Not only can the network traffic be evaluated, but also network properties can be determined. Reported traffic on a local area network can improve mathematical models of traffic for theoretical evaluation and also suggest the traffic handling properties that a local area network and its hosts should have. GRA

N84-23165# National Aerospace Lab., Amsterdam (Netherlands). Informatics Div.

COMPARISON OF PROCESSOR ARRAYS WITH PIPELINE PROCESSORS FOR IMAGE PROCESSING

F. A. Gerritsen 8 Feb. 1983 26 p refs In DUTCH; ENGLISH summary Presented at Bijzondere Rekenautomaten voor Tech. en Wetenschappelijke Toepassingen Symp., The Hague, 26 Jan. 1983

(NLR-MP-83011-U) Avail: NTIS HC A03/MF A01

Parallel computers consisting of an array of processors were compared with pipelined processors with regard to their ease of use and computing speed in image processing applications. Use of parallel computer architectures in spatially and data invariant neighborhood and pixel operations, in spatially and/or data variant image operations, and in global transformations is discussed. The execution speeds and numbers of instruction cycles needed are listed. It is concluded that both types of parallel architecture are suited for the execution of spatially and data invariant image operations, and have difficulties with the efficient execution of spatially and/or data variant image operations. Processor arrays perform better in applications where a mixture of different computing accuracies are used, and in applications where mixtures of algorithms with different lengths are used. Author (ESA)

63 CYBERNETICS

Includes feedback and control theory.
For related information see also *54 Man/System Technology and Life Support.*

N84-23166# Sheffield Univ. (England). Dept. of Control Engineering.
STABILITY AND PERFORMANCE DETERIORATION DUE TO MODELLING ERRORS
D. H. Owens and A. Chotai Aug. 1983 30 p refs Submitted for publication
(Contract SERC-GR/B/23250)
(RR-236) Avail: NTIS HC A03/MF A01

Techniques based on time-domain simulation tests that permit the incorporation of plant modeling errors in the analysis and prediction of stability and performance deterioration due to measurement nonlinearities are described. The procedure analyses the effect of modeling errors on stability and performance in the absence of nonlinearities and uses the results to assess the effect of the nonlinearity. The technique applies to single input/single output and multivariable systems and to analog or digital control schemes. Author (ESA)

N84-23167# Sheffield Univ. (England). Dept. of Control Engineering.
PARAMETERIZATION AND APPROXIMATION METHODS IN FEEDBACK THEORY WITH APPLICATIONS IN HIGH GAIN, FAST SAMPLING AND CHEAP OPTIMAL CONTROL
D. H. Owens, A Chotai, and A. A. Abiri Oct. 1983 43 p refs
(Grants SERC-GR/B/23250; SURF-651)
(RR-241) Avail: NTIS HC A03/MF A01

A technique for constructing a general analysis for approximation methods in studying parameterized high performance control problems is outlined. Modeling errors are formulated in feedback form and contraction mapping analysis is applied. Compatibility between plant and its approximation for stabilization studies, and the concept of ideal parameter values that produce indistinguishable input-output characteristics from the real and approximating feedback schemes are introduced. The analysis is easily extended to feedback schemes incorporating sector-bounded nonlinearities and state feedback, and to control problems such as decoupling controls and disturbance rejection. Author (ESA)

N84-23168 Princeton Univ., N. J.
COMPUTER METHODS FOR INDUSTRIAL AUTOMATION AND ROBOTICS Ph.D. Thesis
Lawrence Emil Zeidner 1983 315 p
Avail: Univ. Microfilms Order No. DA8402672

This research addresses the computer hardware and software systems necessary for the transition of industry from its present state to one of computer-integrated manufacturing. This transition requires the integration of components which are themselves complex hardware and software systems. A generalization of the Virtual Machine computer architecture concept is presented which structures the integration of the complex components. The role of graphical interaction in engineering computing is explored, focusing on the Universal Engineering Workstation as the vehicle for such interaction. The rapid pace of interactive computing heightens the need for specialized proceesors to provide burst-mode computation. Integration of such processors into the general-purpose computing environment is addressed and suitable algorithms are presented. In the envisioned engineering environment problem-solvers use the Universal Engineering Workstation to graphically manage, control, and program application processes; however, they do not write code in the traditional programming fashion.
Dissert. Abstr.

N84-23169 Massachusetts Univ., Amherst.
MODEL REFERENCE ADAPTIVE CONTROL SYSTEMS: THE HYBRID APPROACH Ph.D. Thesis
Roberto Cristi 1983 154 p
Avail: Univ. Microfilms Order No. DA8401052

An Adaptive Control System for continuous time, single input single output linear plants is analyzed. The Model Reference (MRAC) approach is considered, where a reference model - representing the ideal behavior - is implemented and the control structure is given by a network of analog compensators. The final goal of the overall system is to obtain the plant output to track asymptotically the model output, without exact knowledge of the plant transfer function. This achieved by determining the compensator parameters in an adaptive fashion. In the particular setting considered--the Hybrid--the parameters of the compensator are adjusted recursively by a digital computer on the basis of periodic input and output measurements of the plant. The overall system results to be nonlinear, and its stability is thoroughly analyzed.
Dissert. Abstr.

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N84-23170 British Aerospace Dynamics Group, Bristol (England). Guidance and Control Dept.
AN INTRODUCTION TO ADJOINT TECHNIQUES
J. E. Fox 5 Feb. 1981 62 p refs
(BAE-BT-11172) Avail: Issuing Activity

The adjoint method of linear systems simulation is explained and it is shown how the technique may be used to evaluate the sensitivity to initial conditions and the effects of deterministic and random inputs. It is also shown that, in certain classes of problems, use of the technique can enable results to be obtained with considerably less computing effort and cost than is possible with conventional techniques. Author (ESA)

N84-23171# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
VARIABLE SELECTION IN HETEROSCEDASTIC DISCRIMINANT ANALYSIS
L. Paul Fatti and Douglas M. Hawkins Feb. 1983 38 p refs Submitted for publication
(CSIR-TWISK-283) Avail: NTIS HC A03/MF A01

The likelihood ratio test statistic for the identity in means and covariance matrices of k normal populations has a well-known stepdown decomposition measuring the contribution of each component of the vector observation. It is shown that this decomposition in turn gives rise to three components testing the residual homoscedasticity of each variable; the parallelism of its regression on its predecessors; and identity of location. A variety of uses of this decomposition in selecting variables is proposed.
M.G.

N84-23172# Grenoble-1 Univ. (France).
ANNALS OF THE FOURIER INSTITUTE, VOLUME 33, NO. 4 [ANNALES DE LINSTITUT FOURIER, TOME 33, FASCICULE 4]
B. Malgrange, ed. 1983 268 p refs Partly in FRENCH and ENGLISH
(ISSN-0373-0956) Avail: NTIS HC A12/MF A01

Various topics in mathematics are addressed covering: differential operators, group theory, Poisson and Weyl algebras, Picard localization, cohomology, and analytic functions. For individual titles, see N84-23173 through N84-23181.

N84-23173# Universite de Franche-Comte, Bresancon (France). Lab. de Mathematiques.
ON THE Z SUB 2 EXTENSIONS OF AN IMAGINARY QUADRATIC FIELD [SUR LES Z2-EXTENSIONS DU'UN CORPS QUADRATIQUE IMAGINAIRE]
Georges Gras *In* Grenoble-1 Univ. Ann. of the Fourier Inst., Vol. 33, No. 4 1983 p 19-82 refs In FRENCH; ENGLISH summary (For primary document see N84-23172 13-64)
Avail: NTIS HC A12/MF A01

Let k=Q(square root of -m) be an imaginary quadratic field, let k(infinity) and F be its two natural Z sub 2-extensions (the

cyclotomic and the prodiedral one), and let k' be its 2-Hilbert class field. Let P be the completion of k at 2, rho=0 or 1 equals 1 if and only if all odd divisors of M are congruent to + or - mod 8, chi=0 or 1 be the 2-rank of Gal(intersection of k(infinity) and F/k), and t=0,1 or 2 be the 2-rank of Gal(intersection of k(infinity) and k'/k). Chi < or = rho and some elementary cohomological facts give other constraints between P, chi and t, but 2 additional obstructions of arithmetical kind are found which allow one to obtain the classification of the fields k with regard to the variants P, rho, chi, t. All of these results are based on the description of Gal(k(infinity)F/k) by means of a suitable logarithmic function on the ideal group of k. M.G.

N84-23174# Bordeaux Univ. (France). U.E.R. de Mathematiques e d'Informatique.
FORMAL AND GROUP PICARD LOCALIZATION [LOCALISATION FORMELLE ET GROUPE DE PICARD]
J. Fresnel and M. vanderPut (Rijksuniversiteit Groningen) *In* Grenoble-1 Univ. Ann. of the Fourier Inst., vol. 33, No. 4 1983 p 19-82 refs In FRENCH; ENGLISH summary (For primary document see N84-23172 13-64)
Avail: NTIS HC A12/MF A01

Let X be a reduced analytic space over a complete, non-archimedean valued field K. Let X be affinoid with canonical reduction r:X yields bar-X and let p be an element of bar-X. The singularity of the point p is described with the help of certain K-algebra's associated with X namely: (1) the formal localization O sub X,(p) and (2) the formal completion O' sub X,(p); both are noetherian with r sup -1 (p) as their maximal ideal space and with reduction O sub bar-X,p and O' sub bar-X,p respectively. The essential results are obtained for a regular X of dimension 1. One shows the equivalence of: (1) p is an ordinary multiple point; (2) Pic(O' sub X,(p))=(1); and (3) r sup -1(p) is locally isomorphic to P(1) sub K. M.G.

N84-23175# Liege Univ. (Belgium). Inst. de Mathematique.
COHOMOLOGY OF THE 3-DIFFERENTIABLE OF THE POISSON ALGEBRA OF A SYMPLECTIC MANIFOLD [COHOMOLOGIE 3-DIFFERNETIABLE DE L'ALGEBRE DE POISSON D'UNE VARIETE SYMPLECTIQUE]
M. deWilde and P. B. A. Lecomte *In* Grenoble-1 Univ. Ann. of the Fourier Inst., Vol. 33, No. 4 1983 p 83-94 refs In FRENCH; ENGLISH summary (For primary document see N84-23172 13-64)
Avail: NTIS HC A12/MF A01

The Chevalley cohomology of the adjoint representation of the Poisson algebra of a symplectic manifold is studied. In particular, an explicit description of the cohomology of the 2 and 3 differentiable cochains is obtained. M.G.

N84-23176# Paris-Sud Univ., Orsay (France). Dept. de Mathematiques.
THE FOURIER PLANCHEREL TRANSFORM OF THE ANALYTIC LIE GROUP. 1: WEYL ALGEBRAS AND DIFFERENTIAL OPERATORS [LA TRANSFORMATION DE FOURIER-PLANCHEREL ANALYTIQUE DES GROUPES DE LIE. 1: ALGEBRES DE WEYL ET OPERATEURS DIFFERENTIELS]
Nghiem Xuan Hai *In* Grenoble-1 Univ. Ann. of the Fourier Inst., Vol. 33, No. 4 1983 p 95-134 refs In FRENCH; ENGLISH summary (For primary document see N84-23172 13-64)
Avail: NTIS HC A12/MF A01

In the enveloping algebra of a solvable Lie algebra, one can exhibit a characteristic Weyl algebra which is canonical and maximal. There exists a canonical obstruction 2-cocycle to represent the Lie algebra as derivations of this Weyl-algebra. When the Schrodinger's representation of the Weyl-algebra is used, one can produce an analysis primitive of this cocycle and obtain a representation of the Lie algebra as antisymmetrical differential operators of degree not bigger than two. This representation, once exponentiated, will give the Fourier Planchard transform of the analytic Lie group associated to the algebra. M.G.

N84-23177# Fourier Inst., Grenoble (France). Lab. de Mathematiques Pures.
ON A FUNDAMENTAL INEQUALITY AND THE SINGULARITIES OF AN ANALYTIC FUNCTION DEFINED BY THE LC-DIRICHLETIAN ELEMENT [SUR UNE INEGALITE FONDAMENTALE ET LES SINGULARITES D'UNE FONCTION ANALYTIQUE DEFINIE PAR UN ELEMENT LC-DIRICHLETIEN]
M. Blambert and R. Parvatham (Madras Univ.) *In* Grenoble-1 Univ. Ann. of the Fourier Inst., Vol. 33, No. 4 1983 p 135-160 refs In FRENCH; ENGLISH summary (For primary document see N84-23172 13-64)
Avail: NTIS HC A12/MF A01

Using an entire function g is an element of B[1,T] and properties related to its indicator diagram and conjugate diagram, a fundamental inequality is established for the general term of an LC-dirichletian element Sigma P sub n(s)exp(-lambda sub n/s) where lambda sub n Psub n(s) are polynomials. Then, its convergence properties are discussed and the fundamental inequality is used to obtain properties regarding the analytic continuation of the function defined by the LC-dirichletian element. M.G.

N84-23178# Stockholm Univ. (Sweden). Dept. of Mathematics.
THIN SETS IN NONLINEAR POTENTIAL THEORY c67
L. I. Hedberg and T. H. Wolff (California Inst. of Technology, Pasadena) *In* Grenoble-1 Univ. Ann. of the Fourier Inst., Vol. 33, No. 4 1983 p 161-187 refs Sponsored in part by the Swedish Natural Science Research Council (For primary document see N84-23172 13-64)
Avail: NTIS HC A12/MF A01

Let L(q-dimensional, alpha modulo(R(d-dimensional)), alpha>0, 1<q<infinity, denote the space of Bessel potentials f=G(alpha)*g, g is an element of L(q-dimensional), with norm //f//(alpha,q) = //g//(q). For alpha integer L(q-dimensional, alpha modulo) can be identified with the Sobolev space H(alpha,q). One can associate a potential theory to these spaces much in the same way as classical potential theory is associated to the space H(1,2), and a considerable part of the theory was carried over to this more general context around 1970. There were difficulties in extending the theory of thin sets, however. By means of a new inequality, which characterizes the positive cone in the space dual to L(q,alpha), this gap is filled. It is shown that there is a good definition of thin sets, such that the Kellogg and Choquet properties hold, and such that there is a Wiener criterion for certain nonlinear potential. As a consequence of the Kellogg property the spectral synthesis theorem for H(alpha,q), previously proved for q>2-alpha/d, extends to q>1. M.G.

N84-23179# Bielefeld Univ. (West Germany). Fakultaet fuer Mathematik.
ESTIMATES OF ONE-DIMENSIONAL OSCILLATORY INTEGRALS
Detlef Mueller *In* Grenoble-1 Univ. Ann. of the Fourier Inst., Vol. 35, No. 4 1983 p 189-201 refs (For primary document see N84-23172 13-64)
Avail: NTIS HC A12/MF A01

One dimensional oscillatory integrals are studied which arise as Fourier-Stieltjes transforms of smooth, compactly supported measures on smooth curves in Euclidean spaces. Their decay at infinity is determined provided the curves satisfy certain geometric conditions. M.G.

N84-23180# Tunis Univ. (Tunisia). Dept. de Mathematiques.
LITTLEWOOD PALEY'S g FUNCTION ASSOCIATED WITH A SINGULAR DIFFERENTIAL OPERATOR (0, INFINITY) [LA G-FONCTION DE LITTLEWOOD-PALEY ASSOCIEE A UN OPERATEUR DIFFERENTIEL SINGULIER SUR (0, INFINITY)]
A. Achour and K. Trimeche *In* Grenoble-1 Univ. Ann. of the Fourier Inst., Vol. 33, No. 4 1983 p 203-226 refs In FRENCH; ENGLISH summary (For primary document see N84-23172 13-64)
Avail: NTIS HC A12/MF A01

Stein associates to any Sturm-Liouville operator the Littlewood-Paley's g-function and supports the conjecture that for any p in the interval]1,+infinity[there exist two constants C(p) and D(p) such that: C(p)//f//(p)< or = //g(f)//(p)< or = D(p)//f//(p). These inequalities are proved for a class of singular differential

operators on]1,+infinity[and a result on multiplicators for these operators is presented. M.G.

N84-23181# Tokyo Shibaura Electric Co. Ltd. (Japan). Dept. de Mathematiques.
EXPONENTIAL CALCULUS OF MICRODIFFERENTIAL OPERATORS OF INFINITE ORDER, PART 1 [CALCUL EXPONENTIEL DES OPERATEURS MICRODIFFERENTIELS D'ORDRE INFINI. 1]
Takashi Aoki *In* Grenoble-1 Univ. Ann. of the Fourier Inst., Vol. 33, No. 4 1983 p 227-250 refs In FRENCH; ENGLISH summary (For primary document see N84-23172 13-64)
Avail: NTIS HC A12/MF A01

The symbol calculus of microdifferential operators with exponential symbols is discussed. The composition law of exponential symbols is given. As an application, a sufficient condition of ellipticity is found for microdifferential operators of infinite order. M.G.

N84-23182# Puerto Rico Univ., Rio Piedras. Dept. of Physics.
AN EXACTLY SOLVABLE MODEL FOR IDEALLY POLARIZABLE INTERFACES Interim Technical Report
M. L. Rosinberg and L. Blum Feb. 1984 17 p
(Contract N00014-81-C-0776)
(AD-A138719; TR-10) Avail: NTIS HC A02/MF A01 CSCL 12/1

A model for the interface of two interacting one component plasmas of different background densities separated by an impermeable surface, is solved exactly in two dimensions at one special temperature. This model emulates the behaviour of an ideally polarizable interface. The authors obtained density profiles, differential capacity and surface tension as a function of the applied potential. Pertinent sum rules are given. Author (GRA)

N84-23183# Princeton Univ., N. J. Information Sciences and Systems Lab.
MULTI-SENSOR ARRAY TIME-DELAY ESTIMATION WITH SMALL PHASE INCOHERENCES Technical Report, Jan. - Dec. 1983
C. T. Chen and S. C. Schwartz Feb. 1984 26 p
(Contract N00014-81-K-0146)
(AD-A138867; Rept-15) Avail: NTIS HC A03/MF A01 CSCL 12/1

The maximum likelihood (ML) estimator for time-delay in a multisensor array in the presence of small phase incoherences is derived. The structure obtained is the canonical ML estimator with a correction term to compensate for the phase. The Cramer-Rao matrix bound is developed and used to evaluate the standard deviation of the time-delay estimate (TDE) as a function of system parameters such as number of sensors, phase variance, bandwidth and center frequency of the source. The curves indicate a sensitivity, at low input SNR, of the TDE variance to phase standard deviation and signal center frequency. Author (GRA)

N84-23184# Arkansas Univ., Fayetteville. Dept. of Electrical Engineering.
ADAPTIVE HYBRID PICTURE CODING Interim Report, 1 Apr. - 30 Nov. 1983
R. A. Jones and M. K. Cook 30 Nov. 1983 198 p
(Grant AF-AFOSR-0351-82; AF Proj. 2305)
(AD-A138876; AFOSR-84-0142TR) Avail: NTIS HC A09/MF A01 CSCL 12/1

The transmission of digital imagery has become a necessity in recent times. Systems such as communications and weather satellites, facsimile, remote control, and machine intelligence can and do make use of data compression techniques to reduce bandwidth and power consumption. Research on these techniques has led to one form of image data compression which achieves good image quality for intraframe coding at low data rates. This technique is known as Adaptive Stochastic Picture Coding (ASPC) which consists of a one-dimensional unitary transform for column-wise decorrelation used in conjunction with Adaptive Differential Predictive Coding Modulation (ADPCM) for the row-wise decorrelation, followed by quantization to give the desired data compression. This system requires use of quantization techniques which limit system performance. Optimization of adaptive scalar quantizers and use of vector quantizers aid in the adaptation of the system to variations in the image statistics. This report represents a study of such quantizers in the ASPC system. By examining these quantization methods, it will be shown that it is vital that the proper quantizer be incorporated into the system to achieve a particular data rate at desired distortion levels. Author (GRA)

N84-23185# Army Missile Command, Redstone Arsenal, Ala. Guidance and Control Directorate.
DISTURBANCE MINIMIZATION TECHNIQUES FOR LINEAR, TIME-INVARIANT DYNAMICAL SYSTEMS
W. L. McCowan Jul. 1983 317 p
(AD-A138915; AD-E950486; DRSMI/RG-83-15-TR) Avail: NTIS HC A14/MF A01 CSCL 12/1

The objective of this research effort is to compile, refine and extend Disturbance Minimization Control design techniques for linear, time-invariant, regulation and servo-tracking systems. In addition, a collection of example problems are worked-out in detail to illustrate the design techniques and simulation results are used to demonstrate the performance of the resulting controllers. The results of this effort are presented in four parts. Part I, encompassing Chapters I and II, presents a review of the general theory of Disturbance Minimizing Control design techniques, including the ideas of disturbance modeling and control allocation. Several extant methods for minimization of disturbance effects are introduced. Part II, encompassing Chapters III-V, presents an in-depth coverage of methods for designing control parts to effect desired disturbance minimization, for state and output set-point regulation/stabilization and state and output servo-tracking type problems. Part III, encompassing Chapter VI, presents the conclusions and recommendations for further study. Part IV, consisting of Appendices A-G, contains a review of the concept of a matrix generalized inverse and provides detailed examples of disturbance minimizing control design which illustrate techniques presented in Parts I and II. Author (GRA)

N84-23186# Oregon State Univ., Corvallis. Dept. of Electrical and Computer Engineering.
ON A SIMPLE ADAPTIVE TRACKING FILTER
Z. Tang, R. R. Mohler, and W. J. Kolodziej Oct. 1983 21 p
(Contract N00014-81-K-0814)
(AD-A138955; OSU-ONR-TR-83-6) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper presents a simplified adaptive tracking filter for a maneuvering target. The filter is very simple and easy to implement. No prior knowledge of the maneuvering characteristics is needed; the tracking errors are quite small when the target maneuvers. While the target does not maneuver, the tracking errors are a bit larger than others, but are still much smaller than measurement errors. This method can be used either with linear measurements or nonlinear measurements. Simulation results for various target maneuvers are presented. Author (GRA)

N84-23187# Naval Underwater Systems Center, New London, Conn.
NEW FORMULAS FOR HED (HORIZONTAL ELECTRIC DIPOLE), HMD (HORIZONTAL MAGNETIC DIPOLE), VED (VERTICAL ELECTRIC DIPOLE), AND VMD (VERTICAL MAGNETIC DIPOLE) SUBSURFACE-TO-SUBSURFACE PROPAGATION
P. R. Bannister 11 Jan. 1984 56 p
(X07-92)
(AD-A139030; AD-E401136; NUSC-TR-6881) Avail: NTIS HC A04/MF A01 CSCL 12/1

New formulas for the electric and magnetic fields produced by the four elementary dipole antennas have been developed for the subsurface-to-subsurface, subsurface-to-surface, surface-to-subsurface, and surface-to-surface propagation cases. These formulas are of rather simple, but useful, form and are completely general (i.e., the air can easily be replaced by the sea bottom). They are valid at any frequency and at any range beyond a certain

minimum distance for the flat-earth case. The main restrictions on these formulas are that the square of the index of refraction is > or = 10 and that the horizontal separation is > or = 3 times the sum of the depths of burial of the transmitting and receiving point sources. With these new formulas, computer evaluation can be reduced to fractions of a minute, compared with hours for the complete numerical evaluation of the exact Sommerfeld integrals. There also will be an interference pattern set up under certain close-range conditions because the three waves (direct, modified mirror image, and lateral) may interfere, either constructively or destructively, with each other. Author (GRA)

N84-23188# Naval Underwater Systems Center, New London, Conn.
NEW FORMULAS THAT EXTEND NORTON'S FARFIELD ELEMENTARY DIPOLE EQUATIONS TO THE QUASI-NEARFIELD RANGE
P. R. Bannister 11 Jan. 1984 55 p
(AD-A139057; NUSC-TR-6883) Avail: NTIS HC A04/MF A01 CSCL 12/1

New formulas for the electric and magnetic fields produced by the four elementary dipole antennas have been derived for the air-to-air, subsurface-to-air, air-to-subsurface, and surface-to-surface propagation cases. These formulas are of rather simple form and reduce to previously derived results when either (1) the measurement distance is much less than a free-space wavelength, (2) the Sommerfeld numerical distance is small, or (3) the measurement distance is much greater than a free-space wavelength. These are valid at any frequency and at any range beyond a certain minimum distance for the flat-Earth case. GRA

N84-23189# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Mathematics.
FORMULAS FOR THE L-2 MINIMAL SOLUTIONS OF THE DELTA DELTA BAR EQUATION IN THE UNIT BALL OF C SUP N
Mats Andersson 1983 46 p refs Submitted for publication
(CTH-Math-1983-16-Preprint; ISSN-0347-2809) Avail: NTIS HC A03/MF A01

Explicit integral forms for the differential operator delta delta bar in the unit ball of n-dimensional complex space C which yield minimal solutions in certain Lsq spaces are given. Results of divisors of holomorphic functions are restated. Author (ESA)

N84-23190# Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Computer Science.
FACTORING MULTIVARIATE INTEGRAL POLYNOMINALS
A. K. Lenstra Jun. 1983 11 p refs Presented at 10th ICALP, Barcelona, 1983 Submitted for publication
(MC-IW-229/83) Avail: NTIS HC A02/MF A01

A polynomial-time algorithm to factor polynomials in several variables with integral coefficients that is polynomial-time in the degrees of the polynomial to be factored is presented. This algorithm generalizes the algorithm to factor integral polynomials in one variable. Author (ESA)

N84-23191# Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Computer Science.
FACTORING MULTIVARIATE INTEGRAL POLYNOMIALS, PART 2
A. K. Lenstra Jun. 1983 14 p refs Submitted for publication
(MC-IW-230/83-Pt-2) Avail: NTIS HC A02/MF A01

A polynomial time algorithm to factor polynomials in several variables with integral coefficients that is polynomial-time in the degrees of the polynomials that can be reduced in polynomial-time to the univariate case for use of lattice techniques is presented. Author (ESA)

N84-23192# Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Operations Research and System Theory.
ON ORTHOGONAL POLYNOMIALS ON A HALF LINE AND THE ASSOCIATED KERNEL POLYNOMIALS
E. A. vanDoorn May 1983 21 p refs Submitted for publication
(MC-BW-182/83) Avail: NTIS HC A02/MF A01

A sequence of polynomials (P) which is orthogonal with respect to a distribution whose support is contained in real nonnegative numbers is studied. Limit theorems for P are derived. Links between the sets of limit points of zeros of P and the set of kernel polynomials associated with P, and the parameters in the three term recurrence relation for the sequence are established. Author (ESA)

N84-23193*# Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Operations Research and System Theory.
SYMMETRIC SYSTEMS WITH SEMISIMPLE STRUCTURE ALGEBRA: THE QUATERNIONIC CASE
M. Hazewinkel, J. H. Lewis (Case Western Reserve Univ., Cleveland), and C. Martin (Case Western Reserve Univ., Cleveland) May 1983 14 p refs Submitted for publication Prepared in cooperation with Erasmus Univ., Rotterdam
(Grants NAG2-82; NAG-2384; Contract DE-A01-80RA5236)
(NASA-CR-173421; NAS 1.26:173421; MC-BW-185/83) Avail: NTIS HC A02/MF A01 CSCL 12A

Linear systems over the quaternions is discussed. The theory of real, semisimple symmetric systems is outlined. Author (ESA)

N84-23194# Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Pure Mathematics.
THE EQUICONTINUOUS STRUCTURE RELATION AND EXTENSION OF FUNCTIONS DEFINED ON G-SPACES
J. deVries Jun. 1983 23 p refs Submitted for publication
(MC-ZW-192/83) Avail: NTIS HC A02/MF A01

The topological dynamics method is used to show how the equicontinuous structure relation of a subflow is the restriction of the equicontinuous structure relation of the whole flow. Necessary and sufficient conditions are given, in terms of periodic functions on the flow, and in terms of injective objects in the category of all compact Hausdorff G-spaces. Author (ESA)

N84-23195# Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Numerical Mathematics.
LINEAR MULTISTEP METHODS WITH MINIMIZED TRUNCATION ERROR FOR PERIODIC INITIAL VALUE PROBLEMS
P. J. vanderHouwen and B. P. Sommeijer Aug. 1983 14 p refs Submitted for publication
(MC-NW-157/83) Avail: NTIS HC A02/MF A01

Initial value problems whose solution is a priori known to possess an oscillatory behavior are studied using linear multistep methods. Minimization of those terms in the local truncation error which correspond to the oscillatory solution components is outlined. Numerical results are compared with those obtained by the corresponding conventional linear multistep methods and by Gautschi's methods. The minimax method is superior to Gautschi's methods. Author (ESA)

N84-23196# Sheffield Univ. (England). Dept. of Control Engineering.
ON NONLINEAR SYSTEMS AND ALGEBRAIC GEOMETRY
S. P. Banks Oct. 1983 30 p refs
(RR-240) Avail: NTIS HC A03/MF A01

The spectrum of nonlinear systems and frequency-domain theory is defined. It is shown that the natural generalizations of the classical concepts of poles and zeros of linear systems are varieties in two-dimensional projective space. The structure of such varieties are considered and a nonlinear root locus which begins on poles and ends on zeros is obtained. A strong connection between nonlinear systems theory and algebraic geometry is demonstrated. Author (ESA)

N84-23197# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Mathematics.
THE EARLY ROOTS OF BABYLONIAN MATHEMATICS. PART 3: THREE REMARKABLE TEXTS FROM ELBA
Joeran Friberg 1983 23 p refs
(CTH-Math-198314-Pt-3; ISSN-0347-2809) Avail: NTIS HC A02/MF A01

A lexical text with a list of Sumerian number words in syllabic

notation is reproduced. Composite signs for large sexagesimal number units are illustrated. An algorithm for division by a nonregular decimal number is discussed. Author (ESA)

N84-23198# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Mathematics.
A POSTERIORI ERROR ANALYSIS IN L SUB p NORMS FOR THE FINITE ELEMENT METHOD
Kenneth Eriksson 1983 40 p refs
(Contract SWED-NSRC-R-RA-1567-101/102)
(CTH-Math-1983-15; ISSN-0347-2809) Avail: NTIS HC A03/MF A01

Posteriori error estimation in L sub p - norms spaces for finite element solutions of second order elliptic boundary value problems in one and two dimensions is considered. Properties of posteriori error estimators and asymptotic exactness on Lp - norms spaces with the maximum norm are discussed. Author (ESA)

N84-23199# Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Computer Science.
COMPACTNESS IN SEMANTICS FOR MERGE AND FAIR MERGE
J. W. deBakker and J. I. Zucker (New York State University, Amherst) Oct. 1983 18 p refs Submitted for publication
(MC-IW-238/83) Avail: NTIS HC A02/MF A01

The role of compactness in defining the semantics of the merge and fair merge operations is analyzed. The merge operation is investigated in the setting of a simple language with elementary actions, sequential composition, nondeterministic choice and recursion. Metric topology is used to assign a linear time and a branching time semantics to this language. It is shown that the resulting meanings are compact trace sets and compact processes, respectively. For the fair merge, an approach using scheduling through random choices is adopted, since a direct definition precludes the use of closed, let alone of compact sets. In the indirect approach, a compactness condition is used to show that the fair merge of two fair processes yields a fair process. Author (ESA)

N84-23200# Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Computer Science.
BIG OMEGA VERSUS THE WILD FUNCTIONS
Paul M. B. Vitanyi and Lambert Meertens Oct. 1983 10 p refs Submitted for publication
(MC-IW-239/83) Avail: NTIS HC A02/MF A01

The order of magnitude symbols big omega and little omega for orders of infinity are redefined. Properties of logarithmico-exponential functions are given. Author (ESA)

N84-23201# Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Computer Science.
POLYNOMIAL FACTORIZATION BY ROOT APPROXIMATION
A. K. Lenstra Nov. 1983 10 p refs Submitted for publication
(MC-IW-242/83) Avail: NTIS HC A02/MF A01

A constructive version of a fundamental theorem of algebra combined with a basis reduction algorithm is shown to yield a polynomial-time algorithm for factoring polynomials in one variable with rational coefficients. The lattice for the factoring algorithm can be constructed using approximations of the (real or complex) roots of polynomial f to define a lattice that contains a factor of f as shortest nonzero vector. To factor f, compute a sufficiently precise approximation (a) of a root (A) of f, using the reduction algorithm. The minimal polynomial of A which is an irreducible factor of f can then be found by looking for a ZZ-linear relation of minimal degree among the powers of a. It is shown that the coefficients of the linear relation are given by the shortest vector in a certain lattice. Author (ESA)

N84-23202# Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Computer Science.
DISTRIBUTED ELECTIONS IN AN ARCHIMEDEAN RING OF PROCESSORS (PRELIMINARY VERSION)
Paul M. B. Vitanyi Dec. 1983 9 p refs Submitted for publication
(MC-IW-243/83) Avail: NTIS HC A02/MF A01

The use of clocks by individual processors in elections in a ring of asynchronous processors without central control, allows a deterministic solution which requires a linear number of message passes. The clocks measure finitely proportional absolute time-spans for their time units, that is, the magnitudes of elapsed time in the ring network satisfy the axiom of Archimedes. Subtilities associated with distributed computations are highlighted. The known nonlinear lower bound on the required number of message passes is cracked. For the synchronous case, in which the necessary assumptions hold a fortiori, the method is asymptotically the most efficient yet, and of optimal order of magnitude. The deterministic algorithm is of asymptotically optimal bit complexity, and, in the synchronous case, also yields an optimal method to determine the ring size. Author (ESA)

N84-23203# Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Computer Science.
THE SIMPLE ROOTS OF REAL-TIME COMPUTATION HIERARCHIES (PRELIMINARY VERSION)
Paul M. B. Vitanyi Dec. 1983 7 p refs Submitted for publication
(MC-IW-244/83) Avail: NTIS HC A02/MF A01

If the computation power of an assemblage, consisting of a number of copies of a memory device BLAH, communicating through a single finite control, eventually increases by adding more BLAH's, and each such assemblage can be simulated in real-time by a multitape Turing machine, it is shown that an assemblage with k + 1 BLAH copies is more powerful in real-time than one with k BLAH copies, for each k. The hierarchies, within the real-time definable computations, are smooth, that is, adding a device always increases power. All real-time hierarchy results are simple corollaries of a single root: the real-time hierarchy of multipushdown store machines. In real-time, k + 1 tape-units with a fast rewind square are more powerful than k such units; (k + 1)-head tape-units with fast rewind squares are more powerful than k-head tape-units with fast rewind squares; (k + 1)-dequeue machines are more powerful than k-dequeue machines; and (k + 1)-concatenable-dequeue machines are more powerful than k-concatenable-dequeue machines. Author (ESA)

N84-23204# Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Applied Mathematics.
BIFURCATION OF MAP RESONANCE 1 : 4
H. A. Lauwerier Oct. 1983 50 p refs
(MC-TW-245/83) Avail: NTIS HC A03/MF A01

Local behavior of a critical bifurcation point is analyzed using models of population dynamics and epidemiology of the logistic type. A delay term is contained in the case that the multipliers of the equilibrium state are close to + or - i. Theory of normal forms is employed. Author

N84-23205# Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Applied Mathematics.
LOCAL BIFURCATION OF A LOGISTIC DELAY MAP
H. A. Lauwerier Oct. 1983 33 p refs
(MC-TW-246/83) Avail: NTIS HC A03/MF A01

The difference equation x sub n+1 = ax sub n(1-(1-b)x sub n-bx sub n-1) is considered as an iterative Cremona transformation in the projective plane. Only local bifurcation phenomena are considered. It is shown how the theory of normal forms can be used to explain or predict what can be seen on a personal computer with a visual display. The technique of the normal forms is given with an application to a quadratic map of the kind x' = y, y' = Ax + By + Cxsq + Dxy + Eysq. Explicit formulas are given for the shape and the size of the Hopf ellipse and for the axis of the Arnold forms at weak resonance points. Author (ESA)

N84-22840# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
A MODEL FOR ASYNCHRONOUS DISTRIBUTED COMPUTATION

D. P. Bertsekas *In its* Proc. of the 6th MIT/ONR Workshop on C3 (Command, Control, and Commun.) Systems Dec. 1983 p 39-41 (For primary document see N84-22835 13-32)
(Contract N00014-75-C-1183)
(AD-P002879) Avail: NTIS HC A14/MF A01 CSCL 12/1

N84-22841# Naval Ocean Systems Center, San Diego, Calif.
A UNIFIED APPROACH TO MODELING AND COMBINING OF EVIDENCE THROUGH RANDOM SET THEORY
I. R. Goodman *In* MIT Proc. of the 6th MIT/ONR Workshop on C3 (Command, Control, and Commun.) Systems Dec. 1983 p 42-47 (For primary document see N84-22835 13-32)
(AD-P002880) Avail: NTIS HC A14/MF A01 CSCL 12/1

N84-22859# ALPHATECH, Inc., Burlington, Mass.
A FRAMEWORK FOR EVALUATION OF SURVEILLANCE ALGORITHMS
J. L. Weiss and R. R. Tenney *In* MIT Proc. of the 6th MIT/ONR Workshop on C3 (Command, Control, and Commun.) Systems Dec. 1983 p 178-182 Prepared in cooperation with MIT, Cambridge (For primary document see N84-22835 13-32)
(AD-P002901) Avail: NTIS HC A14/MF A01 CSCL 12/1

N84-22860# Scicon Consultancy International Ltd., London (England).
THE USE OF RECIPROCAL POLAR CO-ORDINATES IN PASSIVE TRACKING
A. C. Bamford, E. M. L. Beale, J. Lee, and S. Patel *In* MIT Proc. of the 6th MIT/ONR Workshop on C3 (Command, Control, and Commun.) Systems Dec. 1983 p 198-201 (For primary document see N84-22835 13-32)
(AD-P002906) Avail: NTIS HC A14/MF A01 CSCL 12/1

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N84-23206# University of Central Florida, Orlando. Dept. of Mathematics and Statistics.
ON OBTAINING PHYSICAL MEANING FROM THE PARAMETERS IN THE WEIBULL DISTRIBUTION
S. J. Bean and P. N. Somerville Hanscom AFB, Mass. AFGL 13 May 1983 12 p
(Contract F19628-82-K-0001; AF Proj. 6670)
(AD-A138574; SR-4; AFGL-TR-83-0224) Avail: NTIS HC A02/MF A01 CSCL 12/1

The parameters (alpha, beta) of the Weibull distribution do not lend themselves to physical interpretation. This report illustrates how the mean, median, mode, and other measures may be obtained from (alpha, beta). Tables are given which display the mean, median, mode, and standard deviation as well as the cumulative probability of the distribution for one standard deviation above and below the mean for a number of different combinations of alpha and beta. Author (GRA)

N84-23207# Puerto Rico Univ., Rio Piedras. Dept. of Physics.
THE IDEALLY POLARIZABLE INTERFACE: A SOLVABLE MODEL AND GENERAL SUM RULES Interim Technical Report
M. L. Rosinberg and L. Blum Feb. 1984 67 p
(Contract N00014-81-C-0776)
(AD-A138720; TR-11) Avail: NTIS HC A04/MF A01 CSCL 12/1

A model for an ideally polarizable interface is proposed where the two sides of the interface are described by two interacting classical one component plasmas of different neutralizing background densities separated by an impermeable membrane. The statistical mechanics of this system is solved exactly in two dimensions at the reduced temperature 2. The one and two body distribution functions, the potential drop, the differential capacity and the interfacial tension are computed. The main feature of this model is that the potential drop and not the surface charge appears as the natural external variable. Several sum rules are discussed, such as the screening theorems for multipoles, the contact theorem, and Lippmann's equation. A general thermodynamic argument shows that these sum rules remain valid in three dimensions and for any value of the coupling parameter. Author (GRA)

N84-23208# University of Central Florida, Orlando.
A COMPARISON OF SEVERAL ALTERNATIVES TO MAXIMUM LIKELIHOOD FOR THE WEIBULL DISTRIBUTION
S. J. Bean, P. N. Somerville, and L. A. Franklin 22 Sep. 1983 16 p
(Contract F19628-82-K-0001; AF Proj. 6670)
(AD-A138721; AFGL-TR-83-0248; SR-5) Avail: NTIS HC A02/MF A01 CSCL 12/1

Five methods of parameter estimation for the two parameter Weibull distribution are investigated using simulation. They are: Non-Linear Regression, Log-Linearization, Weighted Least Squares, Generalized Least Squares, and Method of Moments. Effects of contamination and censoring of data as well as robustness of the methods were investigated. Weighted Least Squares seemed to be the most cost-effective method and Nonlinear Regression was the most robust. Author (GRA)

N84-23209# New York City Technical Coll., Brooklyn, N.Y.
DEPENDENCE OF HYDROMAGNETIC ENERGY SPECTRA ON INTERPLANETARY PARAMETERS Final Report, 1 Sep. 1978 - 30 Sep. 1983
A. Wolfe, L. J. Lanzerotti, C. G. Maclennan, L. V. Medford, and A. Meloni Nov. 1983 7 p
(Grant AF-AFOSR-3707-78; AF Proj. 2311)
(AD-A138745; AFOSR-84-0123TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Ground-based magnetometer data, recorded at AT&T Bell Laboratories' stations located at low to mid-latitudes (L=2-4) and AFGL station (L=2-3), have been analyzed to search for associations between dayside Pc3-5 pulsations (15-240 second periods) and solar wind parameters measured by instrumentation on board the IMPJ spacecraft. The statistical analysis techniques used in the work (power spectral analysis, correlation analysis, multiple linear regression methods) have led to the discovery and quantification of relationships between hydromagnetic waves in the magnetosphere as manifested by magnetic pulsations and interplanetary parameters. Multiple linear regression (MLR) analyses showed that the most important interplanetary parameter controlling ground hourly magnetic energy (in the period range 60-240 seconds) was the solar wind speed. MLR analyses further showed that hourly magnetic energy in the 15-60 second period range was also controlled by the solar wind speed but more so by the interplanetary magnetic field direction. GRA

N84-23210# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Mathematics.
POISSON INTEGRALS OF ABSOLUTELY CONTINUOUS AND OTHER MEASURES
Shobha Madan and Peter Sjoegren 1983 18 p refs
(CTH-Math-1983-10; ISSN-0347-2809) Avail: NTIS HC A02/MF A01

Absolutely continuous and continuous measures are characterized by the g-function and distribution function of the Poisson integral in a half space. Other ways of measuring the Poisson integral are found to make such measures indistinguishable. A variant of the Poisson integral is also studied. Author (ESA)

N84-23211# Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Operations Research and System Theory.
A NOTE ON THE OVERFLOW PROCESS FROM A FINITE MARKOVIAN QUEUE
E. A. vanDoorn Mar. 1983 7 p refs Submitted for publication
(MC-BW-179/83) Avail: NTIS HC A02/MF A01

The distribution of the time between overflows for a single server queueing system with finite waiting room and state-

dependent service and arrival rates is determined. A GI/M/infinity system where the arrival process is the overflow process from the M/M/s/r queue is analyzed. Author (ESA)

N84-23212# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Mathematics.
GEOMETRIC BOUNDS ON THE ORNSTEIN-UHLENBECK VELOCITY PROCESS
Christer Borell 1983 22 p refs
(CTH-Math-1983-17; ISSN-0347-2809) Avail: NTIS HC A02/MF A01

Ineqalites are proved for Gaussian Dirichlet integrals by inserting time using symmetrization in Gauss space in terms of the Ornstein-Uhlenbeck velocity process on finite-dimensional linear spaces. The standard solutions of the elementary Cauchy problem are considered. Estimates of hitting probabilities of the Ornstein-Uhlenbeck process in equilibrium are obtained. Author (ESA)

N84-23213# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Mathematics.
AN INTERPOLATION TYPE INEQUALITY FOR A DISCRETE WEIGHTED NORM
Bertil Westergren 1983 19 p refs Submitted for publication
(CTH-Math-1983-30; ISSN-0347-2809) Avail: NTIS HC A02/MF A01

A discrete weighted norm, used to prove interior regularity results for elliptic and parabolic difference equations, is refined. An interpolation type inequality for this refined norm is proved. Regularity results are improved in the elliptic case. Author (ESA)

N84-23214# Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Applied Mathematics.
STOCHASTIC DYNAMICAL SYSTEMS WITH A CYCLIC STRUCTURE
J. V. Lankelma Nov. 1983 31 p refs Submitted for publication
(MC-TW-247/83) Avail: NTIS HC A03/MF A01

The Fokker-Planck and backward Kolmogorov equations are formulated for a dynamic system with a small stochastic perturbation. The dynamics of the deterministic hypercycle are described. The asymptotic approximation of the expected exit time for the attraction domain of a stable point is given. The WKB-Ansatz for the adjoint equation requires a detailed analysis of the eikonal equation at the stable point, using the ray method applied to the cycle with three components. Since the boundary contains singular points, the solution of the adjoint equation has its largest values on the boundary near these points. However, the WKB-approximation breaks down at such (turning) points. Randomly perturbed hypercycles are analyzed by solving stochastic difference equations. Exit times from simulations are compared with the asymptotic expressions. In first order approximation they agree quite well. Author (ESA)

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N84-23215# Office of Naval Research, London (England).
STATISTICS AND OPERATIONS RESEARCH IN EUROPE--1983 Summary Report
D. R. Barr 5 Jan. 1984 15 p
(AD-A138953; ONRL-R-3-84) Avail: NTIS HC A02/MF A01 CSCL 12/1

This report examines work in statistics, operations research, and closely related fields in Europe. Author (GRA)

N84-23216# Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Operations Research and System Theory.
A FRAMEWORK FOR THE PROBABILISTIC ANALYSIS OF HIERARCHICAL PLANNING SYSTEMS
J. K. Lenstra, A. H. G. RinnooyKan (Erasmus Univ., Rotterdam), and L. Stougie Apr. 1983 23 p refs Presented at Intern. Inst. on Stochastics and Optimization Conf., Gargano, Italy, 1-10 Sep. 1982 Submitted for publication
(MC-BW-180/83) Avail: NTIS HC A02/MF A01

Stochastic programs for multilevel decision problems, and hierarchical planning systems designed for their solution, when viewed as stochastic programming heuristics, are discussed. A framework for the design and analysis of heuristics for stochastic programming is outlined. Ways to measure the performance of such heuristics are reviewed, and relations between these measures are derived. The concepts are illustrated on a simple two-level planning problem of a general nature and on a more complicated two-level scheduling problem. Author (ESA)

N84-23217# Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Operations Research and System Theory.
SOME ANALYTICAL ASPECTS OF THE PEAKEDNESS CONCEPT
E. A. vanDoorn May 1983 21 p refs Presented at 10th Intern. Teletraffic Congr., Montreal, 1983 Submitted for publication
(MC-BW-183/83) Avail: NTIS HC A02/MF A01

Peakedness factor is considerrd as variance-to-mean ratio of a particular traffic stream and a representation formula for the peakedness factor of free traffic is given. Properties of this peakedness factor are established for the definition of the peakedness factor as the variance-to-mean ratio for the trunk occupancy distribution resulting when the traffic is offered to an infinite trunk group. Renewal input and exponentially distributed holding times are generalized and results for representations and bounds for the peakedness factor of primary and secondary traffic streams are given. Author (ESA)

N84-23218# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Mathematics.
THE QUEUE G/G/k: FINITE MOMENTS OF THE CYCLE VARIABLES AND UNIFORM RATES OF CONVERGENCE
Hermann Thorisson 1983 25 p refs Submitted for publication
(CTH-Math-1983-24; ISSN-0347-2809) Avail: NTIS HC A02/MF A01

The classical multiserver queue is studied, and finite geometric moments and phi moments of the cycle variables are established for phi(x) = x sup n phi sub 0 (x) where n is integer and phi sub 0 is concave. For systems with different initial conditions, moment and stochastic domination results are proved for the delay variables. Ergodic results for the time and customer dependent processes are obtained. Author (ESA)

N84-23219# Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Computer Science.
PROCESS ALGEBRA SEMANTICS FOR QUEUES
J. A. Bergstra and J. Tiuryn (Warsaw Univ.) Nov. 1983 28 p refs Submitted for publication
(MC-IW-241/83) Avail: NTIS HC A03/MF A01

An unbounded queue over a finite set of data values is modeled as a state transition system. After behavioral abstraction its behavior is a process Q in A infinity where A is the collection of the input and output actions for the queue. A specification of Q by recursion equations, using an auxiliary operator on processes is provided. It is shown that this operator is necessary, since it is not possible to specify Q using recursion equations built from sequential, alternative and parallel composition only. Sequential composition of two queues is shown to produce another queue. Author (ESA)

N84-22838# Naval Postgraduate School, Monterey, Calif.
LANCHESTER'S EQUATIONS AND GAME THEORY
J. M. Wozencraft and P. H. Moose *In* MIT Proc. of the 6th MIT/ONR Workshop on C3 (Command, Control, and Commun.) Systems Dec. 1983 p 24-29 (For primary document see N84-22835 13-32)
(AD-P002877) Avail: NTIS HC A14/MF A01 CSCL 12/1

N84-22862# ALPHATECH, Inc., Burlington, Mass.
INFORMATIONAL ASPECTS OF A CLASS OF SUBJECTIVE GAMES OF INCOMPLETE INFORMATION
D. Teneketzis and D. A. Castanon *In* MIT Proc. of the 6th MIT/ONR Workshop on C3 (Command, Control, and Commun.) Systems Dec. 1983 p 226-231 (For primary document see N84-22835 13-32)
(Contract N00014-82-C-0693)
(AD-P002910) Avail: NTIS HC A14/MF A01 CSCL 12/1

N84-22863# Connecticut Univ., Storrs.
DYNAMIC, HIERARCHICAL DECISION PROBLEMS
P. B. Luh, T. Ning, and T. S. Chang *In* MIT Proc. of the 6th MIT/ONR Workshop on C3 (Command, Control, and Commun.) Systems Dec. 1983 p 249-254 Prepared in cooperation with State Univ. of New York, Stony Brook (For primary document see N84-22835 13-32)
(Grants NSF ECS-81-05984; AF-AFOSR-0098-80; NSF ECS-82-10673)
(AD-P002912) Avail: NTIS HC A14/MF A01 CSCL 12/1

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N84-23220# Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Operations Research and System Theory.
CONNECTIVITY OF CIRCULANT DIGRAPHS
E. A. vanDoorn Jul. 1983 17 p refs Submitted for publication (MC-BW-186/83) Avail: NTIS HC A02/MF A01

An explicit expression for the connectivity (the size of a mimum cut set) of a circulant (directed star polygon) in terms of order n and its symbols is derived. Graph connectivity is classified for the connectivity of its digraph. Author (ESA)

N84-23221# Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Pure Mathematics.
HEREDITARY SUBDIRECT IRREDUCIBILITY IN GRAPHS
Jiri Vinarek (Karlovy Univ., Czechoslovakia) Jun. 1983 12 p refs Submitted for publication Sponsored by Netherlands Ministry of Education and Science
(MC-ZW-193/83) Avail: NTIS HC A02/MF A01

Generalization of characterization theorem for subdirectly irreducible and antireflexive graphs is proved. Systems of anti-reflexive graphs of subdirectly irreducible graphs with hereditary properties are outlined. This generalizes results for the symmetric case. Author (ESA)

N84-23222# Sheffield Univ. (England). Dept. of Control Engineering.
ON SYSTEMS WITH SPECTRAL CLUSTER POINTS AND THEIR RELATION TO H SUP P SPACES
S. P. Banks and F. Abbasi-Ghelmansarai 1983 22 p refs
(RR-235) Avail: NTIS HC A02/MF A01

Root locus theory for distributed systems is extended to include systems whose transfer function is in H to infinity. Examples show that the root locus of such systems differs radically from the finite-dimensional analog, although the classical result that the number of zeros must match the number of poles carries over if the zeros and poles are counted correctly. The system indicates that even the root locus of a finite dimensional system is most naturally conceived of on the Riemann sphere, since then the zeros or poles at infinity are counted in the same way as at any other point. Author (ESA)

N84-23223# Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Applied Mathematics.
LINEAR VOLTERRA CONVOLUTION EQUATIONS: SEMI-GROUPS SMALL SOLUTIONS AND CONVERGENCE OF PROJECTION OPERATORS
S. A. vanGils Dec. 1983 40 p refs
(MC-TW-248/83) Avail: NTIS HC A03/MF A01

The initial function semigroup and the forcing function semigroup generated by linear Volterra integral convolution equations are considered. The two types are proved to be adjoints of each other: the adjoint of one type is the other type semigroup corresponding to the equation with transposed kernel. The semigroups are equivalent. It is shown that the absence of small equations is equivalent to the injectivity of a structural operator which maps initial functions into forcing functions. The convergence of the spectral projection operators corresponding to the (purely) point spectrum of the infinitesimal generators on a dense subset of the state space for a special class of equations is shown.
Author (ESA)

N84-23178# Stockholm Univ. (Sweden). Dept. of Mathematics.
THIN SETS IN NONLINEAR POTENTIAL THEORY
L. I. Hedberg and T. H. Wolff (California Inst. of Technology, Pasadena) *In* Grenoble-1 Univ. Ann. of the Fourier Inst., Vol. 33, No. 4 1983 p 161-187 refs Sponsored in part by the Swedish Natural Science Research Council (For primary document see N84-23172 13-64)
Avail: NTIS HC A12/MF A01

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N84-23224# Joint Publications Research Service, Arlington, Va.
WEST EUROPE REPORT: SCIENCE AND TECHNOLOGY
9 Apr. 1984 49 p Transl. into ENGLISH from various West European articles
(JPRS-WST-84-011) Avail: NTIS HC A03/MF A01

The current status of science and technological reseach in western Europe is reported. General discussions of biotechnology, and research policies, as well as specific topics of advanced materials, aerospce, computers, and microelectronics are reported. Particular attention is given to the industrial applications of the research projects. For individual titles, see N84-23225 through N84-23227.

N84-23225# Joint Publications Research Service, Arlington, Va.
QUALITIES OF SEP CERAMIC-CERAMIC CERASEP COMPOSITES c27
M. B. Malassine *In its* West Europe Rept.: Sci. and Technol. (JPRS-WST-84-011) 9 Apr. 1984 p 1-3 Transl. into ENGLISH from Ing. Automob. (France), Nov.-Dec. 1983 p 77-78 (For primary document see N84-23224 13-70)
Avail: NTIS HC A03/MF A01

The ceramic composite materials Cerasep is discussed with emphasis on thermodynamic properties, surface properties, manufacturing methods and technology utilization. Thermal cycling tests showed high resistance to theral fatigue and cracking. Impact tests indicated high resistance to crack propagation. Suggested manufacturing techniques such as hot sintering, crystallization, gas phase infiltration and layering of preforms are included. The physical characteristics of Cerasep make the ceramic composite useful in applications requiring high thermal stability such as diesel and turbine engines, heat exchangers, and missile nozzles. M.A.C.

N84-23226# Joint Publications Research Service, Arlington, Va.
FRENCH ONERA ACQUIRES U.S. SUPERCOMPUTER FOR RESEARCH c60
In its West Europe Rept.: Sci. and Technol. (JPRS-WST-84-011) 9 Apr. 1984 p 30 Transl. into ENGLISH from AFP Sci. (France), 26 Jan. 1984 p 11 (For primary document see N84-23224 13-70)
Avail: NTIS HC A03/MF A01

The uses of the CRAY-1 computer by The National Office for Aerospace Studies and Research (ONERA) are discussed and include vector analysis, computerized design and testing, systems integration, and network synthesis. The French Aerospace Industry as well as other government departments will share the system

for the development of their own projects. A brief summary of the system capability is included. M.A.C

N84-23227# Joint Publications Research Service, Arlington, Va.
THOMSON SEMICONDUCTORS BIPOLAR IC STRATEGY TO 1986 **c33**
J. P. DellaMussia *In its* West Europe Rept.: Sci. and Technol. (JPRS-WST-84-011) 9 Apr. 1984 p 33-36 Transl. into ENGLISH from Electron. Actualites (France), 24 Feb. 1984 p 1, 15 (For primary document see N84-23224 13-70)
Avail: NTIS HC A03/MF A01

The strategy to develop and market bipolar integrated circuits through 1986 by thomson semiconductors is discussed. Current technology and future research on prototype microprocessors using bipolar integrated circuits is evaluated. The physical properties of the circuits such as heat dissipation, energy consumption rates and response times are studied. M.A.C.

N84-23228# Tohoku Univ., Sendai (Japan). Research Inst. of Electrical Communication.
THE RECORD OF ELECTRICAL AND COMMUNICATION ENGINEERING CONVERSAZIONE TOHOKU UNIVERSITY, VOLUME 52, NO. 4
Mar. 1984 42 p refs In JAPANESE; ENGLISH summary
(ISSN-0385-7719) Avail: NTIS HC A03/MF A01

Molecular beam epitaxy, all aluminum alloy ultrahigh vacuum chambers, surface acoustic wave resonators, electromechanical coupling, computer networks, two level balanced code, binary code, and signal transmission were discussed. For individual titles, see N84-23229 through N84-23231.

N84-23229# Tohoku Univ., Sendai (Japan).
ALL-ALUMINUM-ALLOY UHV CHAMBER FOR MOLECULAR BEAM EPITAXY, 1 **c76**
Maki Suemitsu and Nobuo Miyamoto *In its* The Record of Elec. and Commun. Eng. Conversazione Tohoku Univ., Vol. 52, No. 4 Mar. 1984 p 1-6 refs In JAPANESE; ENGLISH summary (For primary document see N84-23228 13-70)
Avail: NTIS HC A03/MF A01

The first all aluminum alloy (ex. JIS.6263-t6,2219-t87 etc) MBE chamber is constructed and described. After exposure to atmosphere, the chamber is drown to 10(-9) torr in 24 hours, and reaches an ultrahigh vacuum of 1.6x10(-10) torr by a 115 C, 24 bakeout process. The light weight and low cost as well as the short pump-down time and the law outgassing rate of the all aluminum alloy vacuum system seems to have a considerable applicative potentiality for equipment used in semiconductor ultrahigh vacuum processes. Author

N84-23230# Tohoku Univ., Sendai (Japan).
SURFACE ACOUSTIC WAVE RESONATORS IN LAYERED SUBSTRATES WITH LARGE ELECTROMECHANICAL COUPLING COEFFICIENT **c71**
Masao Takeuchi and Kazuhiko Yamanouchi *In its* The Record of Elec. and Commun. Eng. Conversazione Tohoku Univ., Vol. 52, No. 4 Mar. 1984 p 7-26 refs In JAPANESE; ENGLISH summary (For primary document see N84-23228 13-70)
Avail: NTIS HC A03/MF A01

Surface acoustic wave (SAW) resonators employing layered substrates with high temperature stability and large electromechanical coupling coefficient are presented. The reflection of SAW's from aluminum strip electrode arrays located at the interface between an isotropic layer and a piezoelectric substrate, and from grooved arrays located on the free surface of a layer are theoretically analyzed on the basis of the coupled mode theory. The proposed SAW resonators have appreciably small capacitance ratio (= to or approx. 80) and a zero first order temperature coefficient of frequency. Author

N84-23231# Tohoku Univ., Sendai (Japan).
TRANSMITTING TWO-LEVEL BALANCED CODE WITHIN THE BANDWIDTH OF STRAIGHT BINARY CODE-TRANSMISSION **c32**
Ryuichi Sekiya, Tadao M. Nakamura, and Yoshiharu Shigei *In its* The Record of Elec. and Commun. Eng. Conversazione Tohoku Univ., Vol. 52, No. 4 Mar. 1984 p 27-35 refs In JAPANESE; ENGLISH summary (For primary document see N84-23228 13-70)
Avail: NTIS HC A03/MF A01

Two level balanced codes for long distance transmission through optical fibers are reported. As repeater spacing is, due to reducing loss in optical fibers, limited by its bandwidth, the 2 level balanced codes within the bandwidth of straight binary code transmission were transmitted in particular. CMI1/3 and CMI1/4 codes modified from CMI code were chosen in order to overcome the shot noise. Over every rate these codes are suitable for long distance transmission through optical fibers from the point of view of repeater spacing in comparison with straight binary code. Author

N84-23232# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TRANSIENT PROCESSES IN AN INDUCTOR SYSTEM CONSISTING OF A FLAT COIL AND A MULTILAYER CONDUCTING MEDIUM
V. N. Bondaletov, V. P. Gelyetov, and Y. N. Chernov 9 Feb. 1984 15 p Transl. into ENGLISH from Vysokovolt Impuls Tekh. (USSR), No. 1, 1972 p 66-81
(AD-A139053; FTD-ID(RS)T-1726-83) Copyright. Avail: NTIS HC A02/MF A01 CSCL 20/3

The solution of the Maxwell equation for the flat disk coil multilayer conducting medium inductor system with an arbitrary dependence of the exciting current on time, obtained by the successive application of the integral Laplace and Hankel transformations, made it possible to obta the general expressions for the vector potentials in different me The expressions for the vector potentials were also obtai with the connect of a coil-conducting half space system to a vcaying sinusoidal current source. Author

71 ACOUSTICS

Includes sound generation, transmission and attenuation. For noise pollution see *45 Environment Pollution.*

N84-23233* National Aeronautics and Space Administration. Pasadena Office, Calif.
ACOUSTIC ROTATION CONTROL Patent
Daniel D. Elleman (California Inst. of Tech., Pasadena), Arvid P. Croonquist (California Inst. of Tech., Pasadena), and Taylor G. Wang, Inventors (to NASA) (California Inst. of Tech., Pasadena) Issued 20 Dec. 1983 7 p Filed 15 Mar. 1982 Sponsored by NASA
(NASA-Case-NPO-15689-1; US-Patent-4,420,977;
US-Patent-Appl-SN-358089; US-Patent-Class-73-505;
US-Patent-Class-60-721; US-Patent-Class-318-116;
US-Patent-Class-310-300) Avail: US Patent and Trademark Office CSCL 20A

A system is described for acoustically controlled rotation of a levitated object, which avoids deformation of a levitated liquid object. Acoustic waves of the same wavelength are directed along perpendicular directions across the object, and with the relative phases of the acoustic waves repeatedly switched so that one wave alternately leads and lags the other by 90 deg. The amount of torque for rotating the object, and the direction of rotation, are controlled by controlling the proportion of time one wave leads the other and selecting which wave leads the other most of the time. Official Gazette of the U.S. Patent and Trademark Office

N84-23234*# Wyle Labs., Inc., Huntsville, Ala.
ACOUSTIC ENVIRONMENTAL ACCURACY REQUIREMENTS FOR RESPONSE DETERMINATION Final Report
Mark R. Pettitt Dec. 1983 378 p refs
(Contract NAS8-33379)
(NASA-CR-171003; NAS 1.26:171003; WR83-43) Avail: NTIS

HC A17/MF A01 CSCL 20A

A general purpose computer program was developed for the prediction of vehicle interior noise. This program, named VIN, has both modal and statistical energy analysis capabilities for structural/acoustic interaction analysis. The analytic models and their computer implementation were verified through simple test cases with well-defined experimental results. The model was also applied in a space shuttle payload bay launch acoustics prediction study. The computer program processes large and small problems with equal efficiency because all arrays are dynamically sized by program input variables at run time. A data base is built and easily accessed for design studies. The data base significantly reduces the computational costs of such studies by allowing the reuse of the still-valid calculated parameters of previous iterations. Author

N84-23235*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

FAN NOISE REDUCTION ACHIEVED BY REMOVING TIP FLOW IRREGULARITIES BEHIND THE ROTOR - FORWARD ARC TEST CONFIGURATIONS

James H. Dittmar, Richard P. Woodward, and Michael J. MacKinnon 1984 17 p refs Presented at the 107th Meeting of the Acoustical Soc. of Am., Norfolk, Va. 7-10 May 1984

(NASA-TM-83616; E-2047; NAS 1.15:83616) Avail: NTIS HC A02/MF A01 CSCL 20A

The noise source caused by the interaction of the rotor tip flow irregularities (vortices and velocity defects) with the downstream stator vanes was studied. Fan flow was removed behind a 0.508 meter (20 in.) diameter model turbofan through an outer wall slot between the rotor and stator. Noise measurements were made with far-field microphones positioned in an arc about the fan inlet and with a pressure transducer in the duct behind the stator. Little tone noise reduction was observed in the forward arc during flow removal; possibly because the rotor-stator interaction noise did not propagate upstream through the rotor. Noise reductions were maded in the duct behind the stator and the largest decrease occurred with the first increment of flow removal. This result indicates that the rotor tip flow irregularity-stator interaction is as important a noise producing mechanism as the normally considered rotor wake-stator interaction. Author

N84-23236# Pannatoni (Ronald F.), Morristown, N.J.

A NEW EIGENFUNCTION EXPANSION AND ITS APPLICATION TO WAVEGUIDE ACOUSTICS Interim Technical Report, 15 Jun. - 15 Dec. 1983

R. F. Pannantoni 15 Feb. 1984 33 p

(Contract N00014-83-C-0230)

(AD-A138946) Avail: NTIS HC A03/MF A01 CSCL 20/1

This report describes the application of new eigenfunction expansions to the analysis of sound propagation in a two-dimensional waveguide. One boundary of the waveguide is flat, the other boundary is uneven, and the waveguide is filled with inhomogeneous, lossless fluid. The expansions accommodate the conditions that the pressure vanish at the flat boundary and that the normal component of fluid velocity vanish at the uneven boundary. The method of expansion is novel in that two essentially independent functions are expanded simultaneously. Expansions of this kind provide a complete representation of the exact pressure and velocity fields at the boundaries of the waveguide as well as in the fluid. Conditions at the uneven boundary can be satisfied because the eigenvalue problem that generates the expansion functions has a boundary condition that contains the eigenvalue. The eigenvalues are therefore complex even though the waveguide is lossless. The coefficients in the field expansions vary along the direction of propagation. GRA

N84-23237# Oregon State Univ., Corvallis. Dept. of Electrical and Computer Engineering.

UNDERSEA SOUND SPEED AND RANGE ESTIMATION

C. S. Hwang and R. R. Mohler Oct. 1983 38 p

(Contracts N00014-81-K-0814; N00408-82-D-0675)

(AD-A138954; OSU-ONR-TR-83-7) Avail: NTIS HC A03/MF A01 CSCL 20/1

Estimation of an acoustic wave velocity in the ocean and its utilization to improve object localization are studied here. Time delay and/or Doppler shift are measured by the vertically deployed sensors in two-dimensional systems. Various sensor configurations (up to three sensors) are considered. The information rate grows very fast when the measurement equation includes Doppler shift (1DIP, 2DIP). The system is totally unobservable with one sensor (1D), but the system is observable when two or three are employed. Three-sensor, two-delay, one Doppler (2DIP) measurement gives the strongest observability. Several variations of Extended Kalman Filter (EKF) algorithms are tried. Approximated expression of the measurement equation with three sensors (2DIP) shows the best velocity, target range is compared with nonestimated case. As the measurement noise level increases, tracking performance of the estimated case becomes superior to the nonestimated case. GRA

N84-23238# Laboratorium Elektronische Ontwikkelingen voor de Krijgsmacht TNO, Oegstgeest (Netherlands).

COUPLING OF AIRBORNE SOUND IN A SANDY SOIL

H. A. J. M. vanHoof and K. W. F. M. Doorman 19 Sep. 1983 50 p refs

(LEOK-TR-1983-09; TDCK-78614) Avail: NTIS HC A03/MF A01

Acoustic impulses were used to study coupling of airborne sound to unattended seismic sensors. Results show that the predominant portion of airborne excited acoustic energy moves parallel to the surface from source to sensor with the velocity of sound in air, and is coupled into the ground above the sensor. The energy then propagates vertically to the deeper sensors with a velocity of 235 m/sec. In the lower part of the spectrum the acoustically induced signal interferes with the seismic refracted wave induced at the source location. The acoustic and seismic components could be separated. Vertically propagated energy in the soil has little attenuation. Acoustic-seismic coupling can be utilized for characterizing the soil to adapt algorithms for seismic target classification, using the signatures of deeper geophones, which respond more consistently under various distances, source heights and meteorological conditions. Author (ESA)

N84-23239# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).

AERODYNAMIC SOUND GENERATION BY TURBULENT BOUNDARY LAYER FLOW ALONG SOLID AND COMPLIANT WALLS

Frank Obermeier and Willi Moehring Oct. 1983 41 p refs Submitted for publication

(MPIS-116/1983) Avail: NTIS HC A03/MF A01

Flow noise generated by boundary layer flows over solid walls is discussed and the effects of compliant walls on noise generation by boundary layer flows are investigated. The effects of monopole-like and dipole-like sources on noise radiation when nonlinear effects of the wall motion are accounted for are considered. Results suggest that their effects are negligible. Author (ESA)

N84-22642# Georgia Inst. of Tech., Atlanta.

ROCKET MOTOR AEROACOUSTICS

U. G. Hegde and W. C. Strahle *In* APL The 20th JANNAF Combust. Meeting, Vol. 1 Oct. 1983 p 95-106 refs (For primary document see N84-22632 13-20)

Avail: NTIS HC A99/MF A01 CSCL 20/1

N84-22803# Joint Publications Research Service, Arlington, Va.

AUTOMATIC ELIMINATION OF STATIC UNBALANCE OF ROTOR IN ANISOTROPIC BEARINGS Abstract Only

V. P. Nesterenko *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 23 Transl. into ENGLISH from Mashinovedeniye (Moscow), no. 1, Jan. - Feb. 1984 p 24-25 (For primary document see N84-22772 13-31)

Avail: NTIS HC A03/MF A01

N84-23230# Tohoku Univ., Sendai (Japan).

SURFACE ACOUSTIC WAVE RESONATORS IN LAYERED

SUBSTRATES WITH LARGE ELECTROMECHANICAL COUPLING COEFFICIENT
Masao Takeuchi and Kazuhiko Yamanouchi *In its* The Record of Elec. and Commun. Eng. Conversazione Tohoku Univ., Vol. 52, No. 4 Mar. 1984 p 7-26 refs In JAPANESE; ENGLISH summary (For primary document see N84-23228 13-70)
Avail: NTIS HC A03/MF A01

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N84-23240# Armed Forces Radiobiology Research Inst., Bethesda, Md.
KERMA FACTORS FOR USE IN 37-GROUP NEUTRON SPECTRUM CALCULATIONS
G. H. Zeman and W. S. Bice, Jr. Dec. 1983 19 p
(AD-A139033; AD-E401136; AFRRI-TR-83-3) Avail: NTIS HC A02/MF A01 CSCL 06/18

Neutron kerma factors have been regrouped from the format of the International Commission on Radiation Units and Measurements Report 26 (ICRU-26) to supplement those available in the 37-group format of the Oak Ridge Data Library Collection 31 (DLC-31). Lists of regrouped neutron kerma factors are presented for eight elements and for seven compounds and mixtures. For several elements, disagreements in excess of 15% were observed between those neutron kerma factors available in DLC-31 and the regrouped neutron kerma factors of ICRU-26. Author (GRA)

N84-23241# Naval Surface Weapons Center, White Oak, Md.
THE BEAM-DENSITY EFFECT ON ENERGY LOSS OF A RELATIVISTIC CHARGED PARTICLE BEAM Final Report
D. W. Rule Sep. 1983 39 p
(F68-343)
(AD-A139051; NSWC/TR-83-348) Avail: NTIS HC A03/MF A01 CSCL 20/8

Starting from the expression for the cooperative ionization energy loss by a pair of relativistic particles, a formula is derived for the beam-density effect on ionization energy loss for a finite length beam with a Gaussian radial profile. As an example, this formula is evaluated for a 50 MeV, 10 KA electron pulse of one meter length interacting with weakly ionized nitrogen. In this case a large beam-density effect on energy loss was obtained and its dependence on the ionization state of the medium was demonstrated. The relationship of this formulation of energy loss with previous single-particle and beam-plasma loss concepts is discussed. Author (GRA)

N84-23242# Purdue Univ., Lafayette, Ind. Dept. of Chemistry.
INTRAMOLECULAR ELECTRON TRANSFER AT METAL SURFACES. 3: INFLUENCE OF BOND CONJUGATION ON REDUCTION KINETICS OF COBALT (3) ANCHORED TO METAL SURFACES VIA THIOPHENECARBOXYLATE LIGANDS
T. T. T. Li, H. Y. Liu, and M. J. Weaver Nov. 1983 32 p
(Contract N00014-79-C-0670)
(AD-A139066; TR-24) Avail: NTIS HC A03/MF A01 CSCL 07/4

Unimolecular rate constants, K sub et, are reported for the one-electron electroreduction of pentaamminecobalt (III) anchored to mercury, gold, or copper electrodes via various thiophenecarboxylate ligands where the thiophene sulfur acts as the surface binding group and the carboxylate is coordinated to the cobalt reactants. At mercury, the rate parameters were found to be sensitive to the bridging ligand structure, substantially (ca. 10-20 fold) smaller values of K sub et being found for ligands containing one or more methylene groups between the thiophene sulfur and carboxylate oxygen than those featuring uninterrupted bond conjugation between the metal surface donor and Co(III) acceptor sites. Various contributions to these reactivity differences are asse-sed on the basis of the measured variations in the stability constants of the adsorbed precursor state, the rate constants for the homogeneous reduction of these complexes by hexamminеruthenium (II), the unimolecular frequency factors obtained from the electrochemical activation parameters, and by comparison with electrochemical outer-sphere rate data. Taken together, these results provide strong evidence that the smaller values of K sub et values of the electronic transmission coefficient than are achieved with the conjugated ligands. Comparison is made with analogous results for intramolecular electron transfer via extended organic ligands in homogeneous solution. Author (GRA)

N84-23243# California Univ., Berkeley. Lawrence Berkeley Lab.
FORMATION OF NEGATIVE IONS BY CHARGE TRANSFER: He(-) TO Cl(-)
Alfred S. Schlacter Dec. 1983 13 p refs Presented at the 3rd Intern. Symp. on the Production and Neutralization of Negative Ions and Beams, Upton, N.Y., 14-18 Nov. 1983 Revised
(Contract DE-AC03-76SF-00098)
(DE84-005718; LBL-16866-Rev; CONF-831180-12-Rev) Avail: NTIS HC A02/MF A01

Formation of energetic beams of negative ions of elements with atomic numbers 2 to 17 (helium to chlorine) by charge transfer in metal vapors is discussed. DOE

N84-23244# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
ELECTRONICALLY EXCITED PRODUCTS IN THE REACTIONS OF O(3PJ) ATOMS WITH HALOGENATED ETHENES [ELEKTRONISCH ANGEREGTE PRODUKTE IN REAKTIONEN VON O3(PJ)-ATOMEN MIT HALOGENIERTEN ETHENEN]
G. Dornhoefer and W. Hack Feb. 1983 29 p refs In GERMAN; ENGLISH summary
(MPIS-8/1983; ISSN-0436-1199) Avail: NTIS HC A03/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 7,35

The reactions of ground state oxygen atoms with the halogen substituted ethenes CHF3, C2F4, and C2F3 Cl were studied in a discharge flow system via the emission of the electronically excited products. In the reaction with C2F4 the phosphorescence of CF2(a3B1) is observed. A fluorescence of CHF(A1A') is measured with a resolution sufficient to associate the emission to the above state. The relative population of vibronic states in excited CHF is given quantitatively, showing a non-Boltzmann distribution. In the reaction with C2F3 Cl an unresolved emission is obtained which can be regarded as the fluorescence of CFCl(A1A'). Author (ESA)

N84-23245# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
PRIMARY PATTERNS OF ELECTRONICALLY EXCITED MOLECULES IN THE GAS PHASE 2 [PRIMAERPROZESSE ELEKTRONISCH ANGEREGTER MOLEKUELE IN DER GASPHASE 2]
W. Hack, H. Kurzke, and H. Gg. Wagner Jun. 1983 61 p refs In GERMAN
(MPIS-9/1983; ISSN-0436-1199) Avail: NTIS HC A04/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 12,15

The reaction of the amino radical NH2 with metastable oxygen molecules was studied in an isothermal discharge flow reactor with He as carrier gas. The radicals NH2, OH, NH, and NHO were detected by the sensitive and specific laser induced fluorescence (LIF) detection method. Wall activity is found to be between 1.7 and 5.0 times 10 to the power (-4) in a halocarbon wax-coated reactor. The reaction was examined under pseudo first order conditions. In the pressure range between 2.6 and 5.2 mbar and the temperature range between 295 and 353 K, a second order rate constant independent of pressure and temperature is obtained. The OH and NH concentration profiles are directly measured with LIF. The HNO concentration is always below the detection limit. This observation is confirmed by computer simulations. The stable products are identified in IR-absorption experiments. A reaction mechanism used to simulate the measured concentration profiles is given. Author (ESA)

N84-23246# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Mathematics.
ANALYSIS OF A FULLY DISCRETE SCHEME FOR THE NEU-

TRON TRANSPORT IN CYLINDRICAL GEOMETRY
Mohammad Asadzadeh 1984 41 p refs Submitted for publication
(CTH-Math-1984-1; ISSN-0347-2809) Avail: NTIS HC A03/MF A01

Error estimates for a fully discrete method for the numerical solution of the neutron transport equation in cylindrical geometry are established. A quadrature rule for the angular variable, where integration is replaced by a numerical quadrature rule involving a weighted sum over functional values at selected directions, is used. The discontinuous Galerkin finite element method is applied for the spatial variable. Author (ESA)

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation.*

No abstracts in this category.

74 OPTICS

Includes light phenomena.

N84-23247* National Aeronautics and Space Administration. Pasadena Office, Calif.
PROGRAMMABLE SCAN/READ CIRCUITRY FOR CHARGE COUPLED DEVICE IMAGING DETECTORS Patent
Phil M. Salomon (California Inst. of Tech., Pasadena) and Kalman Smilowitz (California Inst. of Tech., Pasadena) Issued 7 Feb. 1984 13 p Filed 24 Jun. 1981 Sponsored by NASA
(NASA-Case-NPO-15345-1; US-Patent-4,430,673; US-Patent-Appl-SN-276749; US-Patent-Class-358-213; US-Patent-Class-358-125) Avail: US Patent and Trademark Office CSCL 20F

A circuit for scanning and outputting the induced charges in a solid state charge coupled device (CCD) image detector is disclosed in an image detection system for use in a spacecraft attitude control system. The image detection system includes timing control circuitry for selectively controlling the output of the CCD detector so that video outputs are provided only with respect to induced charges corresponding to predetermined sensing element lines of the CCD detector. The timing control circuit and the analog to digital converter are controlled by a programmed microprocessor which defines the video outputs to be converted and further controls the timing control circuit so that no video outputs are provided during the delay associated with analog to digital conversion.
Official Gazette of the U.S. Patent and Trademark Office

N84-23248* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DUAL APERTURE MULTISPECTRAL SCHMIDT OBJECTIVE Patent
Peter O. Minott, inventor (to NASA) Issued 24 Apr. 1984 8 p Filed 13 May 1982
(NASA-Case-GSC-12756-1; US-Patent-4,444,464; US-Patent-Appl-SN-378535; US-Patent-Class-350-172; US-Patent-Class-350-173; US-Patent-Class-350-443) Avail: US Patent and Trademark Office CSCL 20F

A dual aperture, off-axis catadioptic Schmidt objective is described. It is formed by symmetrically aligning two pairs of Schmidt objectives on opposite sides of a common plane (x,z). Each objective has a spherical primary mirror with a spherical focal plane and center of curvature aligned along an optic axis laterally spaced apart from the common plane. A multiprism beamsplitter with buried dichroic layers and a concex entrance and concave exit surfaces optically concentric to the center of curvature may be positioned at the focal plane. The primary mirrors of each objective may be connected rigidly together and may have equal or unequal focal lengths.
Official Gazette of the U.S. Patent and Trademark Office

N84-23249 British Aerospace Dynamics Group, Bristol (England).
INFRARED OPTICS: HOLOGRAPHIC AND SURFACE RELIEF DEVICES
R. S. McEwen 10 Apr. 1981 34 p
(BAe-BT-11393) Avail: Issuing Activity

The use of kinoforms in IR holographic and surface relief devices is discussed. Alpha cyanoacrylates are promising for recording volume holograms, particularly if a powerful source of short wavelength, coherent light can be found. The absorption mask method may work better than with photoresists. Polyethylene and polytetrafluoroethylene have a useful degree of transparency in the IR. Although binary level surface relief devices can be made by the photoresist master process, they are not very efficient and can be complicated to encode. Graded level surface relief devices do not involve the theoretical complexities of volume holograms nor the computational problems of binary level phase holograms. A transmissive material which can be molded so that mass replication can be carried out by the same methods as for ordinary Fresnel and other plastic lenses in the visible region is required.
Author (ESA)

N84-23250 British Aerospace Dynamics Group, Bristol (England).
INCORPORATION OF A PROM SPATIAL LIGHT MODULATOR INTO A SYSTEM FOR AUTOMATIC TARGET RECOGNITION AND TRACKING
D. G. Gibson 11 May 1982 40 p refs
(BAe-BT-12841) Avail: Issuing Activity

The Pockels Readout Optical Modulator (PROM) was used to convert images formed in normal, incoherent light into images formed in coherent light. This was done in order to carry out coherent optical data processing upon image data, thus providing a means of recognizing and tracking targets automatically. The PROM was also used as the recording medium for updatable matched spatial filters (MSFs), to allow for range and aspect ratio changes in the target being tracked. The investigation reveals problems in the use of the device for the first application, but automatic tracking from incoherent input data is demonstrated. Updatable MSFs were produced for simple inputs. Author (ESA)

N84-23251*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
LIGHT TRANSMITTING WINDOW ASSEMBLY Patent Application
Dale L. Connelly, inventor (to NASA) Filed 16 Aug. 1983 10 p
(NASA-CASE-MSC-18417-1; US-Patent-Appl-SN-523559) Avail: NTIS HC A01/MF A01 CSCL 20F

This invention provides a light transmitting assembly that changes from a state of transparency to one of translucency. It comprises two parallel spaced apart panes of transparent material, such as glass, with a film of polytetrafluoroethane, which is inherently translucent or opaque, disposed between. The assembly is rendered transparent by introducing a fluid into the assembly to substantially cover a surface of the film; the fluid having a refractive index corresponding to the refractive index of the film. The translucency is restored by removing the fluid. Author

N84-23252# Williams Coll., Williamstown, Mass.
NEAR MILLIMETER WAVE ACTION IN n-GaAs Final Report, 30 Sep. 1980 - 30 Sep. 1983
F. Brown 2 Feb. 1984 9 p
(Contract DAAG29-80-K-0082)
(AD-A138602; ARO-17691.2-EL) Avail: NTIS HC A02/MF A01 CSCL 20/6

Work under this contract was initiated in an attempt to produce population inversion in epitaxial n-gallium arsenides and to observe stimulated emission between the first excited state of donors and

the ground state. The emitted radiation would occur in the far infrared range of the spectrum where few laser sources are available. Such a source would be tuneable by magnetic tuning and would find application in spectroscopy and in communications. Author (GRA)

N84-23253# Massachusetts Inst. of Tech., Cambridge. National Magnet Lab.
PRECISE MEASUREMENT OF REFRACTIVE INDEX AND ABSORPTION COEFFICIENT OF NEAR MILLIMETER WAVE AND FAR INFRARED MATERIALS Final Report, 15 Oct. 1980 - 14 Oct. 1983
M. N. Afsar and K. J. Button Oct. 1983 7 p
(Contract DAAG29-81-K-0009)
(AD-A138656; ARO-17292.7-PH) Avail: NTIS HC A02/MF A01 CSCL 20/6

It is no longer necessary to use extrapolated microwave dielectric values when designing millimeter wave components and systems. Our recent highly accurate broadband millimeter wave data on complex refractive index, complex refractive index, complex dielectric permittivity and loss tangent are now available to engineers for a variety of materials such as common ceramics, semiconductors, crystalline and glass materials. The fact that dielectric loss increases with frequency in the millimeter, unlike the microwave, is an important feature of our data. Reliable measurements also reveal that the methods of preparation of nominally identical specimens can change the losses by a factor of three. GRA

N84-23254# Arizona Univ., Tucson.
FEASIBILITY STUDIES OF OPTICAL PROCESSING OF IMAGE BANDWIDTH COMPRESSION SCHEMES Annual Report
B. R. Hunt, R. N. Strickland, and R. A. Schowengerdt 15 May 1983 70 p
(Grant AF-AFOSR-0170-81; AF Proj. 2305)
(AD-A138736; AFOSR-84-0143TR) Avail: NTIS HC A04/MF A01 CSCL 20/6

This research focuses on these three areas: (1) formulation of alternative architectural concepts for image bandwidth compression, i.e., the formulation of components and schematic diagrams which differ from conventional digital bandwidth compression schemes by being implemented by various optical computation methods; (2) simulation of optical processing concepts for image bandwidth compression, so as to gain insight into typical performance parameters and elements of system performance sensitivity; and (3) maturation of optical processing for image bandwidth compression until the overall state of optical methods in image compression becomes equal to that of digital image compression. Author (GRA)

N84-23255# Stanford Univ., Calif. High Energy Physics Lab.
UV AND VUV DEGRADATION OF VERY HIGH REFLECTIVITY MIRRORS FOR USE IN A STORAGE RING FREE ELECTRON LASER
P. Elleaume, D. A. G. Deacon, M. Billardon, and J. M. Ortega May 1983 7 p Prepared in cooperation with Paris Univ., Orsay (France).
(Contract F49620-80-C-0068; AF Proj. 2301)
(AD-A138740; HEPL-922; AFOSR-84-0105TR) Avail: NTIS HC A02/MF A01 CSCL 20/6

TiO2/SiO2 multilayer dielectric mirrors centered around 630 mm have shown reflectivity degradation from 99.99% down to 99.0% due to UV synchrotron radiation emitted by a beam of 240 MeV electrons during a storage ring free electron laser experiment. GRA

N84-23256# Hughes Research Labs., Malibu, Calif.
REAL-TIME IMPLEMENTATION OF NONLINEAR OPTICAL PROCESSING FUNCTIONS Annual Technical Report, 15 Jun. 1982 - 15 Jun. 1983
B. H. Soffer Dec. 1983 43 p
(Contract F49620-81-C-0086; AF Proj. 2305)
(AD-A138843; AFOSR-84-0141TR) Avail: NTIS HC A03/MF A01 CSCL 20/6

Optical data processing has not yet achieved its potential of increased capacity and speed compared with conventional electronic techniques, primarily for lack of a practical real-time image modulator, and because optical techniques have been almost exclusively limited to linear operations. The continuing research outlined in this report attacks these issues by studying the implementation of real-time nonlinear parallel-processing techniques. The various implementations studied in this program all employed real-time liquid-crystal light valves developed and specially modified for these tasks. GRA

N84-23257# Boeing Aerospace Co., Seattle, Wash.
INVERSION OF EXPERIMENTAL OPTICAL DATA Contractor Report, 13 Aug. 1982 - 13 Sep. 1983
C. D. Capps, A. R. Tokuda, and G. M. Hess Aberdeen Proving Ground, Md. Army Armament, Munitions and Chemical Command Feb. 1984 44 p
(Contract DAAK11-82-C-0104)
(AD-A138979; CRDC-CR-84018) Avail: NTIS HC A03/MF A01 CSCL 20/6

There exist several inversion techniques for inferring the particle size distributions from scattering measurements done on aerosols composed of spherical particles. This report will treat several areas related to the practical application of inversion algorithms to actual experimental measurements to obtain size distributions. The first area to be discussed is the one of which measurements to make. Optimization of the measurement process will be discussed in Section 2. Section 3 presents the data that will be used in the inversion and preliminary analysis. In Section 4 an analytic inversion technique will be applied to the simulated experimental data provided by the Chemical Research and Development Center (CRDC) to obtain particle size distributions. Section 5 will discuss an extension of the analytic inversion method in which constraints can added to improve the inversion and yet the effects of the data and constraints can be separated quantitatively. Recommendations for future research are made in Section 6. GRA

N84-23258# Durham Univ. (England).
THE 1983 INTERNATIONAL CONFERENCE ON FOURIER TRANSFORM SPECTROSCOPY SEPTEMBER 1983
9 Sep. 1983 157 p Conf. held in Durham, England, 5-9 Sep. 1983
(Grant AF-AFOSR-0111-83)
(AD-A139014) Avail: NTIS HC A08/MF A01 CSCL 20/6

The 1983 International Conference on Fourier Transform Spectroscopy is intended to provide a forum at which scientists of all disciplines who are interested in this still rapidly expanding technique can meet to discuss the latest developments. It covers all aspects of the theory, instrumentation and application of Fourier transform interferometric spectroscopy in any part of the electromagnetic spectrum. The conference will be the third in a series, the previous two of which were held at the University of South Carolina in 1977 and 1981. These were known as the International Conferences on Fourier Transform Infrared Spectroscopy. Although it was recognized that any conference on this technique would quite reasonably be dominated by traditional infrared applications, it was also recognized that the important applications are arising in other spectral regions, particularly the millimetric, visible and ultraviolet. Thus, the title was changed for the present conference in order to encourage presentation of some of this new and exciting work. Author (GRA)

N84-23259# California Univ., Livermore. Lawrence Livermore Lab.
ROLE OF ABRASION IN THE OPTICAL POLISHING OF METALS AND GLASS
Norman J. Brown and Lee M. Cook (Schott Optical Glass, Inc.) 13 Jan. 1984 4 p refs Presented at the Topical Meeting on Sci. of Polishing, Monterey, Calif., 16-17 Apr. 1984
(Contract W-7405-eng-48)
(DE84-005737; UCRL-90220; CONF-840498-1) Avail: NTIS

HC A02/MF A01

An abrasive technique for polishing diamond turned optics, a mathematical theory to provide necessary quantified information, and attempts to bridge from metal to glass are reviewed. DOE

N84-23260# California Univ., Livermore. Lawrence Livermore Lab.

NOVOLAC AS STAIN PROTECTIVE FILM DURING OPTICAL GLASS FABRICATION

P. Paul Hed 13 Jan. 1984 7 p Presented at the Topical Meeting on Opt. Fabric. and Testing, Monterey, Calif., 18-20 Apr. 1984

(Contract W-7405-eng-48)

(DE84-005735; UCRL-90194; CONF-840494-2) Avail: NTIS HC A02/MF A01

Certain mixtures of novolac resin in organic solvents are used as stain protective lacquers for polished glass elements. Their preparation and application is described. DOE

N84-23261# Rolls-Royce Ltd., Derby (England).

A HIGH TEMPERATURE OPTICAL DISPLACEMENT MEASURING SYSTEM

R. W. Tuxworth 14 Jun. 1983 12 p Presented at Transducer Tempcon, London, 14 Jun. 1983

(PNR-90186; Reprint-899) Avail: NTIS HC A02/MF A01

An electro-optical technique for measuring axial movements of turbine blade tips is described. Blade tips are illuminated by light transmitted by a rigid single fiber optic light guide. An image is formed on the receiver plane of a coherent fiber optic bundle by a lens; the far end of the bundle is viewed by a TV camera. To achieve good image contrast the blade tip is illuminated so that the tip seal casts a shadow, allowing an edge to be defined on the TV picture. The probes physically survive operation in an engine environment. The head electronics remain cool over the whole range of test conditions. The lens purging system proves very effective. Peak picking is not satisfactory: a jitter of at least + or - 0.009 in. is present. Author (ESA)

N84-22807# Joint Publications Research Service, Arlington, Va.

MEASURING ROUGHNESS OF ULTRASMOOTH SURFACES BY REFLECTOMETRIC METHOD Abstract Only

F. M. Solodukho *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 26-27 Transl. into ENGLISH from Izmeritelnaya Tekhn. (Moscow), no. 10, Oct. 1983 p 17-20 (For primary document see N84-22772 13-31)

Avail: NTIS HC A03/MF A01

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N84-23262 Max-Planck-Institut fuer Plasmaphysik, Garching (West Germany).

AXISYMMETRIC MHD EQUILIBRIA WITH FLOW

W. Kerner and O. Jandl Aug. 1983 49 p refs

(Contract DE-AC02-76ERO-3077)

(IPP-6/230/; IPP-1/220) Copyright. Avail: Issuing Activity

Axisymmetric, ideal MHD configurations with steady flow are computed by applying the finite element method. Rectangular elements with four to eight nodes are used. By mesh rearrangement the equilibria are obtained in flux coordinates. Accurate results without flow and with purely toroidal flow are presented. Author (ESA)

N84-23263# Nagoya Univ. (Japan). Inst. of Plasma Physics.

A CLASSICAL PICTURE OF ANOMALOUS EFFECTS IN A TOKAMAK

K. Hirano Jan. 1984 15 p refs

(IPPJ-664) Avail: NTIS HC A02/MF A01

Atomic collisions between plasma ions and a very small amount of neutral particles remaining in a hot plasma plays a very important role for plasma transports and may be an origin of anomalous effects observed in a Tokamak such as the diffusion coefficient independent of the field strength, a rapid plasma density increase during gas puffing and current penetration with anomalously high speed in the start-up phase. The Ohm's law derived by Cowling is used for the analysis. Author

N84-23264# Nagoya Univ. (Japan). Inst. of Plasma Physics.

EXTERNAL EXCITATION OF ION CYCLOTRON DRIFT WAVES IN A TWO-ION SPECIES PLASMA

M. Kando, S. Ikezawa, and H. Sugai Jan. 1984 14 p refs

(IPPJ-665) Avail: NTIS HC A02/MF A01

Ion cyclotron drift waves propagating across a density gradient and a magnetic field were excited externally in a two-ion species plasma, with its concentration ratio controlled. The measured dispersion relations agree with the theoretical predictions. Author

N84-23265# Nagoya Univ. (Japan). Inst. of Plasma Physics.

MOVING RING REACTOR KARIN-I

Dec. 1983 475 p refs Original contains color illustrations

(IPPJ-660) Avail: NTIS HC A20/MF A01

A conceptual design for a moving ring reactor "KARIN-I" was carried out with a view to prospering activities for fusion system designs in universities and clarifying R & D problems and their priorities to serve the strategy of fusion researches. In order to meet these objectives, the following guidelines were adopted: (1) to design D-T reactor with a tritium breeding blanket, (2) to design a commercial reactor whose net output power in electricity is 500 MWe, (3) to demonstrate compatibility of plasma physics with fusion engineering, (4) a few years to be left for the developments for this concept, and (5) to avoid detailed discussions with respect to systems and system components common to open-ended fusion reactors. Author

N84-23266# Naval Research Lab., Washington, D. C.

THE ELECTRON DENSITY AND TEMPERATURE IN THE PHOTOIONIZED BACKGROUND GAS (N2) SURROUNDING A LASER PRODUCED PLASMA

A. W. Ali 22 Feb. 1984 26 p

(I25-BMXI)

(AD-A138651; NRL-MR-5270) Avail: NTIS HC A03/MF A01 CSCL 20/9

A scheme is presented for the determination of the electron density and temperature in a background gas surrounding a laser produced plasma. The background gas (N2) is photoionized by the ionizing radiation from the laser produced plasma. Band intensities of 3914A and 3371A from N2(+) and N2 are utilized for the determination of the state of the background plasma. Author (GRA)

N84-23267# SRI International Corp., Menlo Park, Calif.

POWER TRANSFER FOR MICROWAVE DISCHARGES Final Report, 20 Sep. 1982 - 31 Dec. 1983

G. August and S. Damron 23 Dec. 1983 42 p

(Contract N00019-82-C-0287)

(AD-A138868) Avail: NTIS HC A03/MF A01 CSCL 20/9

Characteristics of gas breakdown caused by high-power microwaves were studied experimentally. This study concentrated on characterizing the breakdown plasma and on power transfer through the plasma. The integrated electron density was measured via 94 GHz interferometric technique. The decay time of visible light emission from the breakdown plasma was measured to correlate with photographic measurements of size and shape. The effect of echoes within the test chamber on pressure measurements from the discharge was investigated. The topic of enhanced power transfer to a reflecting metal surface, due to formation of a microwave discharge above the surface, was considered. The power transferred in the forward direction through the microwave discharge was measured using a small slit in a reflecting metal plate. Author (GRA)

N84-23268# New Mexico Univ., Albuquerque. Dept. of Chemical and Nuclear Engineering.

PHYSICS OF HIGH TEMPERATURE, DENSE PLASMAS Final Report, 1 Feb. 1979 - 30 Jun. 1982
D. M. Woodall Jan. 1984 173 p
(Grant AF-AFOSR-0060-79; AF Proj. 2301)
(AD-A138872; AFOSR-84-0124TR) Avail: NTIS HC A08/MF A01 CSCL 20/9

The research undertaken under the AFOSR Grant included three related projects: the production and characterization of a dense plasma target for a Relativistic Electron Beam (REB)-Plasma and REB-Neutral Gas heating experiment, the development of plasma diagnostics for REB-Plasma and REB-Neutral Gas heating experiments, and finally, the development of soft X-ray diagnostic techniques of imploding liner experiments. This report has three principal sections. Section II, Characterization of a Dense Plasma Source, summarizes the results of the plasma gun research activities undertaken. That work was in the plasma target production and characterization area for planned REB-Plasma heating experiments. Section III, Intense REB-Neutral Gas Heating Experiments, details the result of diagnostic development for experiments performed in this area. Section IV, Space and Time Resolved Spectroscopy of High Energy Density Aluminum Plasmas, presents results of such measurements made on the plasma produced by the SHIVA imploding foil experiment. GRA

N84-23269# California Univ., Berkeley. Lawrence Berkeley Lab. Accelerator and Fusion Research Div.
DESIGN AND FABRICATION OF A SURFACE CONVERSION NEGATIVE ION SOURCE AND AN 80 keV PRE-ACCELERATOR
C. A. Matuk, O. A. Anderson, L. A. Biagi, K. H. Berkner, W. S. Cooper, K. W. Ehlers, J. Kwan, K. N. Leung, A. F. Lietzke, Y. Maruyama et al Dec. 1983 6 p refs Presented at the 10th Symp. on Fusion Eng., Philadelphia, 5-7 Dec. 1983
(Contract DE-AC03-76SF-00098)
(DE84-006753; LBL-16179; CONF-831203-111) Avail: NTIS HC A02/MF A01

The design and fabrication of a surface conversion negative ion source and an 80 keV preaccelerator intended for use as a confirmation demonstration leading to a radiation hardened 400 keV TFF based beamline for the next generation mirror or Tokamak reactor is described. Experience gained in a previous source and accelerator module was utilized to redefine the overall design and construction for this second generation CW device. The source will provide 1 to 2 amps of H(-) for acceleration by a 3 electrode 80 keV preaccelerator. Particular attention was placed on the mounting of the source to the primary high voltage insulator, the insulator itself, magnet installation, converter shape and construction, cesium injector and exit aperture design, and accelerator construction, with an overall emphasis on serviceability. DOE

N84-23270# Department of Energy, Washington, D. C. Energy Research Advisory Board.
MAGNETIC FUSION ENERGY RESEARCH AND DEVELOPMENT Final Report
Feb. 1984 73 p
(DE84-007089; DOE/S-0026) Avail: NTIS HC A04/MF A01

Substantial progress was made in the three years since the previous ERAB review, although budget constraints precluded the engineering initiatives recommended in that review and authorized in the Magnetic Fusion Energy Engineering Act of 1980. Recognizing that the goals of the Act cannot now be met, the Panel recommends that the engineering phase be further postponed in favor of a strong base program in physics and technology, including immediate commitment to a major new Tokamak-based device for the investigation of an ignited long-pulse plasma designated in this report as the burning core experiment (BCX). Resources to design such a device could be obtained from within theexisting program by redirecting work toward BCX. At this time it is not possible to assess accurately the potential economic viability of fusion power in the future. The Panel strongly recommends expansion of international collaboration, particularly the joint construction and operation of major facilities, such as the proposed BCX. DOE

N84-23271# California Univ., Berkeley. Lawrence Berkeley Lab. Accelerator and Fusion Research Div.
RFQ DEVELOPMENT AT LBL
John Staples Jan. 1984 12 p refs Presented at the Intern. Symp. on Heavy Ion Accelerators and Their Applications to Inertial Fusion, Tokyo, 23-27 Jan. 1984
(Contract DE-AC03-76SF-00098)
(DE84-006762; LBL-17203; CONF-840142-2) Avail: NTIS HC A02/MF A01

A heavy ion Radio Frequency Quadrupole (RFQ) linac is being designed which will be used for the injection of light ions into the PS complex. Other RFQ accelerators are under study for possible additional projects. The vane mounting and adjusting mechanism, and the electrical shorting rings stabilize the cavity field distribution. A design procedure was derived, optimized for low current, heavy ion RFQ's which results in a short, efficient structure. DOE

N84-23272# Oak Ridge National Lab., Tenn. Fusion Energy Div.
OPTIONS FOR AN IGNITED TOKAMAK
John Sheffield Feb. 1984 32 p refs
(Contract W-7405-eng-26)
(DE84-007927; ORNL/TM-8924) Avail: NTIS HC A03/MF A01

The next phase of the fusion program will involve a Tokamak with the goals of providing an ignited plasma for pulses of hundreds of seconds. A simple model is described in this memorandum which establishes the physics condition for such a self-sustaining plasma, for given ion and electron thermal diffusivities, in terms of R/a, b/a, I, B/q, epsilon (BETA)/sub p/, anti T/sub i/, and anti T/sub e//anti T/sub i/. The model is used to produce plots showing the wide range of Tokamaks that may ignite or have a given ignition margin. The constraints that limit this range are discussed. DOE

N84-23273# Science Applications, Inc., Boulder, Colo. Plasma Research Inst.
A rf-INDUCED STABILITY OF MIRRORS WITH INVERTED PRESSURE PROFILES
D. A. Dippolito and J. R. Myra Feb. 1984 37 p refs
(Contract DE-AC03-76ET-53057)
(DE84-007018; SAI-84-3011; PRI-72) Avail: NTIS HC A03/MF A01

The stability of an axisymmetric tandem mirror with an inverted (or hollow) pressure profile is treated within the framework of scalar-pressure, ideal magnetohydrodynamics. A two-surface sharp boundary model is formulated to describe the low-m ballooning stability of the annular plasma in the paraxial limit. Included in the analysis are the stabilizing effects of an externally-applied force, such as the RF-induced ponderomotive force, and of a perfectly-conducting lateral wall. There is a stability boundary associated with each of these effects. In critical ranges of the plasma's annular thickness, the RF intensity and the wall position, the stability regions merge giving complete stability at all values of the plasma pressure. DOE

N84-23274# Fom-Instituut voor Plasmafysica, Jutphaas (Netherlands).
ELECTRON CYCLOTRON EMISSION (ECE) MEASUREMENTS ON THE TORTUR 3 TOKAMAK Ph.D. Thesis - Utrecht State Univ.
R. M. Niedstadt Oct. 1983 46 p refs Sponsored by Euratom and Nederlandse Organisatie voor Zuiver-Wetenschappelijk Onderzoek
(Rept-83-148) Avail: NTIS HC A03/MF A01

The TORTUR 3 Tokamak temperature profiles with turbulent heating pulses were determined using the second harmonic of the electron cyclotron emission (ECE) spectrum. Several groups of accelerated electrons were observed in the first msec of the discharge and during turbulent heating. Polarization measurements yield the ratio of ordinary and extraordinary mode of

emission, and the reflection coefficient of TORTUR 3 at the position of the ECE antenna. Electron density was determined using the presence of a cut-off layer in the plasma. Author (ESA)

N84-23275# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Plasmaphysik.
HYDRODYNAMIC THEORY OF CONVECTIVE TRANSPORT ACROSS A DYNAMICALLY STABILIZED DIFFUSE BOUNDARY LAYER
H. Gerhauser Sep. 1983 82 p refs
(JUEL-1869; ISSN-0366-0885) Avail: NTIS HC A05/MF A01

Transport phenomena in the diffuse boundary layer between miscible liquids (decay of the density profile into several steps; periodic peeling of density sheets off the boundary layer; appearance of steady vortex flow) are discussed. The basic mechanism is identified as formation of convective cells leading to enhanced diffusion. A nonlinear treatment of the stationary convective flow problem gives the saturation amplitude of the ground mode and provides an upper bound for the maximum convective transport. The hydrodynamic model can be used for visualizing similar transport processes in the plasma of toroidal confinement devices, such as sawtooth oscillations in soft disruptions of Tokamak discharges. For anomalous diffusion by excitation of convective cells, results suggest that the maximum possible transport is of the order of Bohm diffusion. Author (ESA)

N84-23276# Stuttgart Univ. (West Germany). Inst. fuer Plasmaforschung.
[ACTIVITIES REPORT OF THE INSTITUT FUER PLASMAFORSCHUNG] Annual Report, 1982
1982 19 p refs
Avail: NTIS HC A02/MF A01

Research concerning electron cyclotron resonance heating, plasma theory, laser plasma diagnostics, plasma focus, and the HECTOR high voltage belt pinch is summarized. A gyrotron was installed. A tunable CO2-waveguide laser was developed for stimulating single lines of a radiation pumped FIR laser. Investigations of the influence of impurities on the thermal ion scattering spectrum were completed. Laser scattering experiments were performed at the 500 kJ experiment POSEIDON. Investigations for the scaling of the neutron emission at high currents (2 to 3 MA) show an increasing shift of the emission towards the macroscopically stable pinch phase, which lasts longer with increasing current. Author (ESA)

N84-22781# Joint Publications Research Service, Arlington, Va.
TELEVISION SYSTEM FOR MONITORING TARGET POSITION IN LASER THERMONUCLEAR FUSION EXPERIMENTS Abstract Only
B. L. Vasin, A. D. Valuyev, O. L. Goryachuk, A. Ye. Danilov, R. G. May, G. V. Sklizkov, S. I. Fedotov, and S. A. Chaushanskiy *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 7-8 Transl. into ENGLISH from Pribory i Tekhn. Eksperimenta (Moscow), no. 5, Sep. - Oct. 1983 p 160-162 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

N84-22788# Joint Publications Research Service, Arlington, Va.
THERMAL CHARACTERISTICS OF PLASMA REACTORS WITH CYLINDRICAL AND CONICAL MULTIJET MIXING CHAMBERS Abstract Only
I. S. Burov, Ye. M. Yermolayeva, V. K. Zabrodin, and A. L. Mosse *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 12 Transl. into ENGLISH from Vestsi Akad. Nauk BSSR: Ser. Fiz. Enerhetychnykh Navuk (Minsk), no. 4, Oct. - Dec. 1983 p 85-88 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

N84-23277# Electrotechnical Lab., Ibaraki (Japan).
ENERGY LOSS OF 24.8-MeV ELECTRONS BY INTERACTING WITH THICK LAYERS OF C, Al, Cu, AND Pb
Tomohisa Mikado Nov. 1983 108 p refs
(ETL-836; ISSN-0366-9106) Avail: NTIS HC A06/MF A01

From the points of view of radiation dosimetry and shielding, or for the check of or guide to various theoretical calculations concerning radiation dosimetry, reliable knowledge of the energy loss process of electrons in matter is essentially very useful. Energy spectra of electron emerging from thick layers of materials bombarded with 24.8-MeV electrons were measured systematically at the Electrotechnical Laboratory (ETL). The systematic measurement was made as a part of long-standing projects for establishing standardization and precise-measurement techniques of high-energy radiations. Experimenal study on energy loss of 24.8-MeV electrons in matter is described. Main purposes of the present work are: to investigate experimentally the thickness dependence of the average energy loss of electrons per unit thickness in matter; and to present experimental data on the most probable energy loss and additional broadening of energy distribution caused by the electron straggling in a material. Energy spectra of electrons emerging from C, Al, Cu, and Pb were measured at various emission angles theta including backward directions.
Author

N84-23278# Rockwell International Science Center, Thousand Oaks, Calif. Science Center.
FERROELECTRIC TUNGSTEN BRONZE BULK CRYSTALS AND EPITAXIAL THIN FILMS FOR ELECTRO-OPTIC DEVICE APPLICATIONS Semiannual Technical Report, 1 Apr. - 30 Sep. 1983
R. R. Neurgaonkar and L. E. Cross Feb. 1984 63 p
(Contract N00014-82-C-2466; DARPA Order 4540)
(AD-A138693; SC5340.4SA; SATR-2) Avail: NTIS HC A04/MF A01 CSCL 20/6

SBN:50 and SBN:60 crystals have now been grown with improved optical quality using the Czochralski technique with automatic diameter control. The liquid phase epitaxial (LPE) growth of SBN:50 on SBN substrates has also been successfully demonstrated, with particularly good results for (100) and (110) film orientations. Electro-optic measurements on SBN:60 single crystals have shown a high value for r51 of 80 x 10 to the minus 12th power m/v, nearly a factor a 2 greater than for SBN:75. The tungsten bronze system Pb1-xBaxNb2O6 (PBN) has shown enhanced piezoelectric, dielectric and optical properties near the morphotropic boundary at x = 0.37. Substantial data on the physical properties of PBN single crystals is presented as a function of composition. Work on an appropriate flux system for LPE growth of PBN is in progress, with particular focus on the system Pb2V2O7 - PBN:60. Systematic work on the tungsten bronze system Ba2NaNb5O15 Sr2NaNb5O15 (BNN-SNN) and Pb2K-Nb5O15 - Ba2NaNb5O15 (PKN-BNN) has been undertaken, with both systems showing morphotropic boundary conditions with enhanced dielectric properties. Both systems look promising for future electro-optic development. Author (GRA)

N84-23279# Honeywell, Inc., Minneapolis, Minn. Solid State Electronics Div.
FINE LINE ELECTROMIGRATION. THE EFFECT OF CROSSED THERMAL GRADIENTS Final Technical Report, 1 Jul. 1981 - 30 Jun. 1983
P. G. Brusius Griffiss AFB, N.Y. RADC Sep. 1983 69 p
(Contract F30602-81-C-0227; AF Proj. 2306)
(AD-A138854; RADC-TR-83-224) Avail: NTIS HC A04/MF A01 CSCL 20/12

Electromagnetic is the phenomenon where current flow in conductors causes a momentum exchange which can, under

certain conditions, result in mass transport in the conductor. Conducting material accumulates in some places on a line; voids are also created. In integrated circuits, this mechanism manifests itself in the form of high resistance lines, open circuits and/or whisker growth, which can lead to failures. Screening for the defects which cause electromigration is time consuming, difficult, and inappropriate for VLSI. While the factos contributing to electromigration in 5 micron/Integrated Circuit geometries are reasonably well understood, there is an uncertainty in evaluating VLSI electromigration reliability because of the potential lack of applicability of simple stripe test data to actual VLSI microcircuits. This study examines the effect of crossed thermal gradients on electromigration. Section II reports some thermal modeling of silicon structures that estimated possible gradients. Section III describes a specially designed test vehicle that features an implanted resistor heat source which produces a crossed thermal gradient on electromigration test stripes. Section IV and V discuss the thermal and physical characterization of the test samples. Section VI details the results of accelerated tests which compared lifetimes of test stripes experiencing a realistic crossed thermal gradient with life-times of controls. GRA

N84-23280# Varian Associates, Palo Alto, Calif. Solid State Lab.
LOW-COST GaAs SOLAR CELL DEVELOPMENT Final Report, Sep. 1981 - Sep. 1983
M. J. Ludowise Wright-Patterson AFB, Ohio AFWAL Dec. 1983 71 p
(Contract F33615-81-C-2025; AF Proj. 3145)
(AD-A138938; AFWAL-TR-83-2090) Avail: NTIS HC A04/MF A01 CSCL 20/12

An abbreviated program to design and develop a thin, low-cost GaAs solar cell for space applications is described. Due to funding limitations, the scheduled four-year program was terminated at the two-year point. Several growth runs utilizing the metal organic-chemical vapor phase (MO-CVD) epitaxial process were made in an attempt to optimize the solar cell structure. Both p/n and n/p growths were made with varying emitter thickness and doping levels. Cell thinning for selected cells was successful to less than 10 microns using a special stop-etch technique. These cells were covered prior to thinning to provide strength and reduce the probability of breakage. Author (GRA)

N84-23281# New York State Univ., Binghamton.
TESTABILITY OF VLSI (VERY LARGE SCALE INTEGRATION) LEAKAGE FAULTS IN CMOS (COMPLEMENTARY METAL OXIDE SEMICONDUCTOR) Final Technical Report, Jul. 1981 - Dec. 1982
Y. K. Malaiya and S. Y. H. Su Griffiss AFB, N.Y. RADC Sep. 1983 97 p
(Contract F30602-81-C-0222; AF Proj. LDPP)
(AD-A138978; Rept-240-6176-A; RADC-TR-83-202) Avail: NTIS HC A05/MF A01 CSCL 20/12

With the advent of VLSI (Very Large Scale Integration), the importance of CMOS (Complementary Metal Oxide Semiconductor) technology has increased. CMOS offers some very significant advantages over NMOS, and has emerged very competitive. Therefore, testability of CMOS devices is of considerable importance. CMOS devices exhibit some failure modes which are not adequately represented by the classical stuck-at fault model. A new fault model is introduced here to represent such faults. Leakage faults are specifically examined in this report, such faults increase the static supply current (which is ordinarily quite low) substantially. A leakage testing experiment consists of applying different vectors to the circuit, and in each case measuring the static supply current. This experimentally obtained data is then analyzed to obtain fault-related information. Leakage testing offers extra testability without any additional pins. It can detect some faults which cannot be detected by the conventional testing. Test generation for several basic CMOS structures is considered. Correspondence between leakage testing and conventional testing is studied. Two methods for analyzing experimental data are presented. Available experimental data was analyzed to obtain statistical information. GRA

N84-23282# Massachusetts Inst. of Tech., Cambridge.
InP MATERIALS Annual Technical Summary Report, 1 Oct. 1982 - 30 Sep. 1983
G. W. Iseler 30 Sep. 1983 27 p
(Contract F19628-80-C-0002; AF Proj. 2306)
(AD-A138992; ESD-TR-83-241) Avail: NTIS HC A03/MF A01 CSCL 20/2

This report covers the work on InP materials carried out with support of the Department of the Air Force during the period 1 October 1982 through 30 September 1983. A part of this support was provided by the Rome Air Development Center. Residual donors in polycrystalline ingots and nominally undoped LEC boules have been identified by photoluminescence studies. The growth striations in doped LEC boules have been greatly reduced by increasing the seed of crucible rotation rates to promote mixing in the melt. Author (GRA)

N84-23283# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TECHNOLOGY OF THE RADIATION HARDENED MOS DEVICES
M. Dragan, I. Draghici, D. Sachelarie, and M. Sachelarie 14 Feb. 1984 19 p Transl. into ENGLISH from Studii si Cercetari de Fiz. (Romania), v. 33, no. 3, 1981 p 285-296 Original language document was announced as A81-028697
(AD-A138995; FTD-ID(RS)T-0031-84) Avail: NTIS HC A02/MF A01 CSCL 20/12

During technological processes such as ion doping, plasma corrosion or X-ray lithography, radiation effects can be harmful to MOS devices used in the space, military and nuclear industries. Silicon and silicon dioxide preparation for radiation resistant MOS devices is reviewed. To obtain the lowest possible threshold voltage (1-2 V of 1,000,000 rad) the following points are outlined: (1) the silicon must be of the (100) type; (2) the optimum oxidation temperature should be between 850 to 1000 C, while the sintering temperature should be between 460 to 500 C; (3) aluminum doping can be useful. Silicon, silicon dioxide and metallization preparation and subsequent treatments are presented to achieve a very low shift in the threshold voltage under neutron radiation of a 10 to 4th power rad (si) total dose. E.A.K.

N84-23284# Purdue Univ., Lafayette, Ind. Dept. of Chemistry.
AN EXPERIMENTAL ESTIMATE OF THE ELECTRON-TUNNELING DISTANCE FOR SOME OUTER-SPHERE ELECTROCHEMICAL REACTIONS
J. T. Hupp and M. J. Weaver Nov. 1983 22 p
(Contract N00014-79-C-0670)
(AD-A139049; TR-20) Avail: NTIS HC A02/MF A01 CSCL 20/12

Estimates of the reaction zone thickness over which electron tunneling can effectively occur for the outer-sphere electrochemical reduction of some Cr(III) complexes are obtained by comparing the observed work-corrected rate constants with unimolecular rate constants for the electroreduction of structurally similar surface-bound Cr(III) reactants. Effective reaction zone thicknesses of ca. 0.1-0.3 A and ca. 5 A are obtained for outer-sphere electron transfer with Cr(III) reactants containing predominantly aquo or ammine ligands, respectively. This indicates that the former reactions are marginally nonadiabatic whereas the latter are decidedly adiabatic at their respective places of closest approach. These findings are compatible with the greater reactant-electrode separation distances previously noted for Cr(III) aquo relative to ammine complexes resulting from the more extensive hydration sheath surrounding the former reactants. Author (GRA)

N84-23285# Stanford Univ., Calif. Lab. of Physics.
RF PROPERTIES OF SUPERCONDUCTING A-15 COMPOUNDS Final Technical Report, 15 Jun. 1982 - 14 Jun. 1983
M. R. Beasley and H. A. Schwettman Dec. 1983 24 p
(Contract N00019-82-C-0286)

(AD-A139067; GL-3675) Avail: NTIS HC A02/MF A01 CSCL 20/3

The extremely low surface resistance exhibited by superconductors makes possible some interesting and important applications in microwave electronics. Chief among these are: (1) the use of high-field superconducting cavities as high-power, coherent, pulsed, microwave sources; and (2) the use of low-loss, low-dispersion RF striplines as communication links or delay elements in high-speed digital and analog signal processing circuits. The specific interests of this contract were the former. For these applications the most promising superconductors are those with a high transition temperature (high T sub c), since they have the best potential performance characteristics (lowest losses and highest magnetic field breakdown). In addition, because of their higher operating temperature, these superconductors may be interfaced with small cryogenic refrigerators. The primary objective of this program has been to study the RF properties of the high-T sub c, A15 superconductors E.G., Nb3Sn (T sub c approx. 18K) and V3Si (T sub c approx. 15K), and in particular, to establish their RF superconducting characteristics and the relationship between these characteristics and their material properties. GRA

N84-23286# California Univ., Berkeley. Lawrence Berkeley Lab. Engineering and Technical Services Div.

DEEP LEVEL IMPURITIES IN GERMANIUM AND SILICON: LOW TEMPERATURE PASSIVATION OR REMOVAL TECHNIQUES

S. J. Pearton, A. J. Tavendale (Australian Atomic Energy Commission), J. M. Kahn, and E. E. Haller Oct. 1983 7 p refs Presented at the Nucl. Sci. Symp., San Francisco, 19-21 Oct. 1983

(Contract DE-AC03-76SF-00098)

(DE84-006772; LBL-15943; CONF-831015-37) Avail: NTIS HC A02/MF A01

Deep level impurities and defects in high-purity germanium and silicon radiation detectors are often the cause of degraded spectral resolution. Exposure of the semiconductor diode to a low pressure hydrogen plasma may neutralize the electrical activity of a wide range of line and point defects and contaminating impurities, such as copper in Ge and gold in Si. The efficiency and thermal stability of this technique are discussed. The application of other methods of defect removal, such as the room temperature drifting of charged defects out of the depletion region under the action of the electric field in a diode, and the recombination enhanced annealing of radiation damage centers in Ge is also discussed. DOE

N84-23287# California Univ., Berkeley. Lawrence Berkeley Lab. Materials Science and Mineral Engineering Div.

CHARACTERIZATION OF SINGLE CRYSTAL Cu/SUB 2S/CdS HETEROJUNCTIONS BY HING RESOLUTION ELECTRON MICROSCOPY

T. Sands, R. Gronsky, and J. Washburn Dec. 1983 18 p refs Presented at the SPIE Tech. Symp. and Instrument Exhibit, Los Angeles, 22 Jan. 1984

(Contract DE-AC03-76SF-00098)

(DE84-006761; LBL-17141; CONF-840139-2) Avail: NTIS HC A02/MF A01

The effect of CdS surface orientation on the phase distribution and morphology of the Cu2S/CdS heterojunction is investigated. The first high resolution transmission electron microscope (HRTEM) images of CU2S/CdS interfaces reveal the presence of the metastable tetragonal phase in heterojunctions formed in terraced CdS surfaces. This observation is rationalized by considering the effects of lattice misfit, and the factors influencing the nucleation of hexagonal close packed to face centered cubic transformation dislocations. The implications of this result for the reproducible fabrication of high efficiency Cu2S/CdS solar cells are discussed. DOE

N84-23288# Argonne National Lab., Ill. Materials Science and Technology Div.

GEOMETRIC RATIONALE FOR HYDROGENATED Pd3P/SUB 1-X

D. G. Westlake Jan. 1984 29 p refs Presented at the Intern. Symp. on the Prop. and Appl. of Metal Hydrides, Eilat (Israel), 9-13 Apr. 1984

(Contract W-31-109-eng-38)

(DE84-006737; CONF-8404106-1) Avail: NTIS HC A03/MF A01

Hole sizes and intersite distances were calculated for all the types of interstices in Pd3P/sub 1-x/H/sub n/, which has the structure of cementite (Fe3C) and belongs to space group Pnma. In Pd3, P/sub 0.80/D/sub 0.15/, hole radii range from 0.87A to 0.43A for the following interstices, in descending order: 4c (phosphorous vacancies in triangular prisms); 8d(1) (distorted square pyramids); 4c(1) (distorted square pyramids); 4a (distorted octahedra); 4c(2), 8d(2) and 8d(3) (tetrahedra). A repulsive interaction between hydrogen and phosphorus atoms was invoked in order to rationalize the observed failure of hydrogen to occupy any of these large interstices except the 8d(1) which is associated with a vacant phosphorus site. Hydrogen occupation of one 8d(1) site blocks its sister site, which is at a distance of only 0.84A and located symmetrically at the other side of the same vacant phosphorus site. No other 8d(1) site blocks that same site, however, because of the great distance (almost 3.3A) to the next-nearest neighbor. DOE

N84-23289# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Electrical Engineering.

MEASUREMENT AND CALCULATION OF PARAMETERS IN THE SILOX DIFFUSION PROCESS

C. J. H. Heijnen and B. H. vanRoy Jan. 1983 20 p refs In DUTCH; ENGLISH summary

(EUT-83-E-133; ISBN-90-6144-133-1; ISSN-0167-9708) Avail: NTIS HC A02/MF A01

The parameters in the silox diffusion process were determined before and after diffusion. Sheet resistance, diffusion depth, surface concentration, and resistivity were determined for the fabrication of semiconductor devices. These parameters depend on the background concentration, the impurity concentration in the silicon oxide, the diffusion temperature, and the diffusion time. Author (ESA)

N84-23290# Telefunken Electronic G.m.b.H., Heilbronn (West Germany).

PRODUCTION ORIENTED 3-5 EPITAXY Final Report, Sep. 1982

Harald Matthes and Wolfgang Gramann Bonn Bundesministerium fuer Forschung und Technologie Dec. 1983 64 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-T-83-286; ISSN-0340-7608) Avail: NTIS HC A04/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 13,50

Vapor phase epitaxy reactors are described. One prototype and one production reactor for the growth of GaAs 0.6 P 0.4 layers on GaAs and two reactors for GaAs1-xPx:N (x = 0.65; 0.85) layers on GaP were constructed and tested. Results show a capacity of 75 sq in. per epitaxy, clean working conditions, automatic process control, and easy maintenance. The reactors satisfy most of the requirements for production oriented 3-5 epitaxy. Author (ESA)

N84-23229# Tohoku Univ., Sendai (Japan).

ALL-ALUMINUM-ALLOY UHV CHAMBER FOR MOLECULAR BEAM EPITAXY, 1

Maki Suemitsu and Nobuo Miyamoto *In its* The Record of Elec. and Commun. Eng. Conversazione Tohoku Univ., Vol. 52, No. 4 Mar. 1984 p 1-6 refs In JAPANESE; ENGLISH summary (For primary document see N84-23228 13-70)

Avail: NTIS HC A03/MF A01

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N84-23291# Centre National de la Recherche Scientifique, Orleans (France). Centre de Recherches sur la Chimie de la Combustion et des Hautes Temperatures.
THERMODYNAMICS AND KINETICS OF THE GAS PHASE AND PACK ALUMINIDE COATING FORMATION ON IRON AND STEEL
B. Nciri and L. Vandenbulcke 1983 7 p refs Presented at 4th European Conf. on CVD, 1983
Avail: NTIS HC A02/MF A01

A gas-solid diffusion model which includes the multicomponent equilibriums of the gaseous phase with the pack and the substrate, was used to study the influence of the relative rates of gas transport and solid state diffusion on the pack-aluminization process. The surface composition of the coatings and their growth rate depend on the temperature and the aluminum activity in the pack, for a given activator. Theoretical predictions for deposition in the gas phase, on substrates out of contact with the pack, can be qualitatively deduced. They agree qualitatively with the experimental results. The conditions necessary to obtain uniform coatings in the gas phase are relatively low temperature and low aluminum activity in the pack. Author (ESA)

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

N84-23292# Office of the Under Secretary of Defense for Research and Engineering, Washington, D. C.
REPORT OF THE DOD-UNIVERSITY FORUM WORKING GROUP ON ENGINEERING AND SCIENCE EDUCATION Final Report
Jul. 1983 83 p
(AD-A138205) Avail: NTIS HC A05/MF A01 CSCL 05/9

Long-term U.S. economic growth requires better use of R&D resources and closer interaction of the academic, government, and industrial research communities. The federal government has proposed to increase support for university research as a key means of addressing national needs for new knowledge in fields important to industrial development and for training of technical personnel. But continuing growth in support for basic research depends on how well the science community can agree on what research investments will have the greatest impact in producing new knowledge. The President assigned high priority to strengthening our national base of scientific and technical personnel. That included immediate emphasis on training people and in the areas of science and technology that were likely to have the greatest impact on both industrial growth and national defense. The needs of the Department of Defense for trained technical personnel, and the current capabilities of the university community for producing an adequate supply of qualified engineers and scientists, is the subject of this report of the DoD-University Forum Working Group on Engineering and Science Education. GRA

N84-23313# Oklahoma City Air Logistics Center, Tinker AFB, Okla.
TRAINING ACQUISITION PERSONNEL THROUGH A LOCAL COLLEGE Final Report
E. R. Watters and H. A. Main *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 108-110 (For primary document see N84-23293 13-81)
(AD-P002766) Avail: NTIS HC A24/MF A01 CSCL 15/5

N84-23379# Defense Logistics Agency, Alexandria, Va.
EMPLOYMENT CHANGES RESULTING FROM THE AWARD OF CONTRACTS IN LABOR SURPLUS AREAS Final Report
D. Robinson and D. Gill *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 517-525 (For primary document see N84-23293 13-81)
(AD-P002834) Avail: NTIS HC A24/MF A01 CSCL 15/5

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N84-23293# Air Force Business Research Management Center, Wright-Patterson AFB, Ohio.
PROCEEDINGS OF THE FEDERAL ACQUISITION RESEARCH SYMPOSIUM WITH THEME: GOVERNMENT, INDUSTRY AND ACADEME: SYNERGISM FOR ACQUISITION IMPROVEMENT Final Report
L. K. McLaughlin and J. S. Peck Dec. 1983 560 p Symp. held at Williamsburg, Virginia on 7-9 December 1983
(AD-A137700) Avail: NTIS HC A24/MF A01 CSCL 15/5

The proceedings contains 93 papers presented which include following topics: Acquisition Automation; Acquisition Information Management; Acquisition Risk and Uncertainty; Acquisition Strategy; Acquisition Workforce; Balancing Government and Industry Interactions; Capital Investment Initiatives; Competition; Contracting Methods; Contracting Strategy; Cost Applications; Cost Growth Control; Cost Impact of Product Rate Variation; Estimating and Pricing Analysis; Industrial Preparedness; Integrated Logistics Support; Management of Support Resources; Market Research and Analysis; Multinational Applications and Innovations; Product Assurance; Program Management; Related Aspects of Productivity Improvement; Socio-Economic Considerations; Source Selection. For individual titles, see N84-23294 through N84-23383.

N84-23294# Air Force Space Div., Los Angeles, Calif.
OFFICE AUTOMATION IN THE ACQUISITION ENVIRONMENT Final Report
J. M. Barry *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 2-4 (For primary document see N84-23293 13-81)
(AD-P002747) Avail: NTIS HC A24/MF A01 CSCL 15/5

The Defense Meteorological Satellite Program embarked on automating the office functions associated with word processing, data delivery, financial and management information in March, 1981. This paper describes some of the planning, experiences, and lessons learned involved with automating the acquisition environment within the program. This description includes specifying the hardware, software, communications and interfaces involved in tying together not only the program office, but also the contractors, and operating and supporting agencies. Finally, the paper evolves recommendations for future directions in automating the acquisition environment. Author (GRA)

N84-23295# Air Force Space Div., Los Angeles, Calif.
THE MICROCOMPUTER IN THE ACQUISITION ENVIRONMENT Final Report c80
M. Ecung *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 5-11 (For primary document see N84-23293 13-81)
(AD-P002748) Avail: NTIS HC A24/MF A01 CSCL 15/5

Headquarters Space Division in Los Angeles took the initiative in adopting the microcomputer as a viable tool to improve overall operations. After a little better than 18 months there are over 200 terminals on station. Most are split between 4 and 8 user multiprocessor systems. Our primary goal in both microcomputer hardware and software acquisition is to stay away from proprietary products that can lock the user into a particular vendor for systems support and modification. The result of our November 1981 design decision was hardware configured around the Z80 microprocessor

using the S-100 (IEEE-696) Bus. Standardized user interface was included by specifying a keyboard configuration of NASA'S Jet propulsion Laboratory design with 40 programmable function keys. Eight inch single side, single density floppy disk drives (IBM format 3740) were chosen because they represent the one industry wide standard in disk formating. Though most of this work was done in a Contracting office the conclusions are relevant to all. We feel the experience of our period of experimentation with Office Automation can aid other offices considering taking this course of action. We have had both positive and negative result with our effort, but the overall conclusion is that: (1) micro-computer office automation can not be avoided; and (2) we have only scratched the surface of its applications in the acquisition environment.

Author (GRA)

N84-23296# Army Armament Munitions and Chemical Command, Rock Island, Ill.

PAPERLESS SOLICITATION AND CONTRACTING Final Report

G. T. Nickolas *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 12-16 (For primary document see N84-23293 13-81)

(AD-P002749) Avail: NTIS HC A24/MF A01 CSCL 15/5

This paper examines the contract simplification effort currently undergoing prototype development in the services under the Defense Acquisition Improvement Program. This effort has led the author to explore the state of the art of contracting and what changes will have to be made to methods of contracting to keep pace with the commercial marketplace in the next decade. Further, the computer is becoming as common as the telephone in every office. The use of the computer seems to be unlimited, ranging from games to sending electronic mail. This paper provides what the author perceives as a step by step advancement needed by the Government in the use of computers to transition from formal paper contracts transported by mail to paperless contracting transmitted via telephone lines or satellite to contractors and between contractor and Government agencies. This paper explains the author's concept of the various elements of paperless contract evolution which must be achieved to allow the release of solicitations via computers, and the eventual award of contracts via computers.

Author (GRA)

N84-23297# Air Force Systems Command, Wright-Patterson AFB, Ohio.

MECHANIZED CONTRACT DOCUMENT PREPARATION AND ABSTRACT SYSTEM Final Report

T. L. Bono *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 18-22 (For primary document see N84-23293 13-81)

(AD-P002750) Avail: NTIS HC A24/MF A01 CSCL 15/5

We have developed a system that revolutionizes contract document preparation by taking advantage of state-of-the-art technology in combining the functions of word processing (WP) and data processing (DP). This system has been proven effective in reducing document preparation time, in producing a better quality document, and reducing document errors. The system simultaneously captures data to be abstracted and fed into a Management Information System (MIS) ensuring that the contract document and abstracted data in the MIS are identical. Since contract documents are mostly text, the WP capability was most important, yet the abstract of specific information could not be accurately and efficiently captured in WP mode. To streamline the data capture portion of the system for abstracting, DP was needed. Finally, to produce a finished product containing both the text and abstracted data, WP and DP had to be efficiently integrated. Through complex software development, we supplemented the vendor software development, we supplemented the vendor software to build a successful prototype system that is undergoing acceptance testing. The system is still in its infancy, but it has taken great strides in increasing the efficiency of contractual document preparation and abstracting. Yet to come is distributed processing of edit and validation routines currently being accomplished on the mainframe computer.

Author (GRA)

N84-23298# Air Force Systems Command, Wright-Patterson AFB, Ohio.

THE ACQUISITION MANAGEMENT INFORMATION SYSTEM: FRIEND OR FOE? Final Report c82

C. R. Cook *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 23-27 (For primary document see N84-23293 13-81)

(AD-P002751) Avail: NTIS HC A24/MF A01 CSCL 15/5

AFSC's Acquisition Management Information System (AMIS) is a complex, extensive computer system containing detailed information on over 61,000 contracts. This paper describes the history and development of AMIS, plus recent actions taken by the Directorate of Contract Data Systems to improve system user-friendliness. A survey of field activities revealed several unsatisfied user needs, especially in data input/output. The Distributed Processing for Contractural Input (DPCI) system was designed and programmed to fill some of these needs. The genesis and growth of DPCI is treated, including software design and hardware acquisition. The paper also covers a fundamental change in management philosophy--expanded participation of system users in establishing and prioritizing system development and change. A new AMIS Users Group was established to advance the effective use of AMIS through the interchange of information concerning system design, use, operation and maintenance. More emphasis is also being placed on improving data base accuracy and completeness. Management education has been stressed. The paper explains steps taken in these and other areas and comments on future system changes to further enhance user-friendliness.

Author (GRA)

N84-23299# Defense Logistics Agency, Alexandria, Va.

CONSOLIDATION OF DOD BIDDER'S MAILING LIST APPLICATION Final Report c82

E. Parsons *In* AF Business Res. Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 28-31 (For primary document see N84-23293 13-81)

(AD-P002752) Avail: NTIS HC A24/MF A01 CSCL 15/5

This paper describes a need to streamline the processing of Bidder's Mailing List (BML) Applications, Standard Form 129, as supplemented, and at the same time, takes the first step toward modernizing an important element in our acquisition process. History has shown us that wars are lost because of the lack of supplies in the right place at the right time. With today's modern weapons systems, flight faster than sound, capability to land on the Moon and return to Earth and numerous other spectacular accomplishments, it would be negligent not to concentrate also on our ability to support these system with rapidity and effectiveness. The consolidation of the BML applications to one or more locations would be cost-effective for Government and industry. This paper will support the need to consolidate the bidder's mailing list applications. It will also point out that the need to consolidate could well be the first step in streamlining the acquisition process.

GRA

N84-23300# Cockerham (John M.) and Associates, Inc., Hopewell, Va.

COST RISK TRADE-OFFS IN TIMING THE PRODUCTION DECISION Final Report c83

J. M. Cockerham *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 33-38 (For primary document see N84-23293 13-81)

(AD-P002753) Avail: NTIS HC A24/MF A01 CSCL 15/5

The question before every development and acquisition program, is when should production resources be committed? The actual decision to enter production is normally assumed to be the same point in time where the expenditure of production monies is authorized or initiated. This assumption is challenged through the analysis of the total cost risk of of the combined RDT&E and production programs versus time. Consideration is given to technical risk, program termination liabilities, RDT&E spending rates, production spend rates, cost of program stretchout, production lead times and return on investment. The purpose is to present and explore the primary financial factors and inter-

relationships to determine the optimum time to expand production monies independent of the final production decision. The methods and principals are demonstrated by an example derived from an actual application on a major weapon system. Author (GRA)

N84-23301# Air Force Systems Command, Wright-Patterson AFB, Ohio.
MANAGING PROGRAM RISK: ONE WAY TO REDUCE COST GROWTH Final Report
L. Cooper *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 39-42 (For primary document see N84-23293 13-81)
(AD-P002754) Avail: NTIS HC A24/MF A01 CSCL 15/5

Former Deputy Secretary of Defense, Frank C. Carlucci, in his 30 April 1981 memorandum on Improving the Acquisition Process recognized that the key to reducing program costs is to establish and maintain a stable program. One of his initiatives requires the Services to budget to most likely or expected costs, including predictable cost increases due to risk; and to provide incentives for acquisition officers and industry to make and use realistic cost estimates. This paper focuses on how the program manager can reduce cost growth through a Risk Management Program that provides a more complete assessment of program risks. The essential elements of a risk management program, a proposed approach to implementing the program, and the advantages associated with successful implementation on major weapon systems acquisitions are outlined. In summary, OSD has demonstrated a commitment to reducing cost growth. Success, however, will require the program managers to establish a risk management program that forces consideration of all program risks before they occur. Author (GRA)

N84-23302# Air Force Business Research Management Center, Wright-Patterson AFB, Ohio.
DECISION TECHNOLOGY: THE CATALYST FOR ACQUISITION IMPROVEMENT Final Report
R. P. Swank and H. M. Wales *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 43-48 (For primary document see N84-23293 13-81)
(AD-P002755) Avail: NTIS HC A24/MF A01 CSCL 15/5

It is possible to manage all activities in a weapon acquisition with a system that predicts and achieves desired results. DECISION TECHNOLOGY provides the Program Manager with the exact information he needs to synthesize all program elements to accurately predict performance probability without compromising management style or objectives. It embraces a basic language that simplifies understanding and communication and applies a fundamental logic that clarifies the implications of each management action. It presents the RISK and CONSEQUENCE visibility in a format that enables the Program Manager to make necessary decisions and confidently defend them knowing they will achieve the results expected. Therefore, all the weapon system expectations are precisely known at all times. DECISION TECHNOLOGY applied in over seventy applications has resulted in significant savings in cost and time along with achievement of predictable outcomes. Author (GRA)

N84-23303# Army Logistics Management Center, Fort Lee, Va.
DESIGNING THE EQUITABLE RISK CONTRACT Final Report
R. F. Williams *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 49-53 (For primary document see N84-23293 13-81)
(AD-P002756) Avail: NTIS HC A24/MF A01 CSCL 15/5

Department of Defense contracting faces such great uncertainty that contracts must be designed to share the resultant risk. This paper describes the steps for this risk-sharing: assessing sources of uncertainty and their probability of impact, assessing the impact of their uncertainties on both contractual partners' objectives, combining these impacts for total risk to the objectives, prioritizing the parties objectives, arraying the 2 sets of prioritized risk in order to equate them, and selecting the proper contractual devices to bring on this equity. The paper also suggests what research might be done on: (1) assessing the impact of uncertainties on contractual objectives, (2) developing operations research models to optimize risk sharing, (3) the impact of contractual devices on objectives, and (4) the design of experiments to effect this research. Author (GRA)

N84-23304# University of Southern California, Los Angeles.
ASSUMPTION OF RISK IN THE R AND D ENVIRONMENT Final Report
J. H. Gill *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 60-63 (For primary document see N84-23293 13-81)
(AD-P002757) Avail: NTIS HC A24/MF A01 CSCL 15/5

There has been a traditional philosophy regarding the use of different types of contracts to share risk during the development of a major weapon system. This philosophy would have the Government assume the burden of risk early in the life of the system through the use of Cost Type contracts. As the requirement becomes more defined, the burden of risk is gradually transferred to the contractor with a commensurate increase in potential profit. If we accept the premise that the Acquisition system requires improvement, what are the alternatives that may be considered to alter the process? A method that has been utilized by the Ballistic Missile Office has been to dramatically alter the traditional concept of assumption of risk by offering Contractors the opportunity to take their fate into their own hands and assume a major share of the cost risk while simultaneously reducing the risk associated with technical failure. GRA

N84-23305# Army Armament Research and Development Command, Dover, N. J.
AN ANALYSIS OF THE ACQUISITION STRATEGY DECISION PROCESS ALONG THREE DIMENSIONS OF THE ACQUISITION IMPROVEMENT PROGRAM Final Report
H. A. Heinz *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 64-77 (For primary document see N84-23293 13-81)
(AD-P002758) Avail: NTIS HC A24/MF A01 CSCL 15/5

This study investigates the acquisition strategy decision process as it relates to the major themes of the Acquisition Improvement Program (AIP). Further, it examines a wide spectrum of acquisition, program, contracting, and industry considerations. The study isolated variables critical to the AS decision process, defined their causal relationships, and produced a causal model. Findings support the notion that a program's effect on the industrial base, readiness/sustainability, and cost can be pre-determined from a specific number of program factors. Further, their effects can be enhanced or otherwise altered by a few, key AS approaches/factors. The findings also suggest that programs with limited competition at the subsystem level fare better than those predicted on the extremes of either open competition with component breakout or restricted to a sole source of the systems level; that a moderate, middle-of-the-road AS approach is more effective for most programs. GRA

N84-23306# Department of the Army, Washington, D. C.
SKUNKWORKS 81 REVISITED: AN UPDATE ON ACQUISITION STRATEGY Final Report
J. E. Longhouser *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 78-81 (For primary document see N84-23293 13-81)
(AD-P002759) Avail: NTIS HC A24/MF A01 CSCL 15/5

A paper on competitive prototyping was presented by Mr. William Stansberry, Deputy Product Manager for Armor Training Devices, at the Interservice Industry Conference in December 1981. That paper coined the phrase Skunkworks 81, meaning a combination of the Skunkworks applied to earlier Air Force projects and competitive prototyping in full-scale development. The paper was well received and accurately reported the Conduct of Fire Trainer (COFT) development at that time. The promulgation of the well-trodden DOD Acquisition Initiatives and the much needed emphasis on streamlining the acquisition cycle provide reason for updating Skunkworks 81. The author of this update, recently assigned as Product Manager for Armor Training Devices assesses

the results of the COFT application of competitive prototyping and discusses the impact this acquisition strategy has had on transition from development to production for the largest procurement of a training simulator ever negotiated. Author (GRA)

N84-23307# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
ASSESSING CONTRACTING WORKFORCE REQUIREMENTS IN THE MATRIXED ORGANIZATION Final Report
A. J. Goebel, C. W. Kipp, and R. M. See *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 83-87 (For primary document see N84-23293 13-81)
(AD-P002760) Avail: NTIS HC A24/MF A01 CSCL 15/5

Aeronautical Systems Division (ASD), within the Deputy for Contracting and Manufacturing, on Air Force Systems Command, we believe our most critical resource to be people. Therefore, how we allocate this workforce becomes a primary ingredient to the success of our mission. The purpose of this paper is to explain how contracting personnel are managed and allocated within our matrix organization. We intend to show you how we started; our growing pains in developing a model for evaluating workload; the results of our efforts and finally, our plans for future improvements. Author (GRA)

N84-23308# Air Force Space Div., Los Angeles, Calif.
CLOSING THE GAP BETWEEN R AND D AND APPLICATION IN ACADEME TO BETTER SUPPORT GOVERNMENT AND INDUSTRY Final Report
Y. F. Howerton *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 88-89 (For primary document see N84-23293 13-81)
(AD-P002761) Avail: NTIS HC A24/MF A01 CSCL 15/5

To successfully accomplish the goals implicit in defense research and development, (R&D), the interrelationship of Government, Industry, and Academe deserves increased attention. While the relationship between Government and Industry has been firmly established, it is in the Academic arena that a better clarity of direction regarding the pursuit of research and development is needed. The lag between research and development and applications is greater in education than in almost any other field. This is particularly unfortunate at a time of a technological resurgence. Perhaps this vacuum can best be examined by looking at the changing trends in education. Until most recently the emphasis on scientific training was not a major priority in the secondary schools and universities. Only recently has attention been drawn to the increasing technological advances and shortage of qualified personnel. With the assistance of funds from the Government, Industry, and Private Foundations like the Alfred P. Sloan Foundation and others; an emphasis on scientific training has taken on a new emphasis. Author (GRA)

N84-23309# Corps of Engineers, Washington, D.C.
THE LEADER OF THE ARMY ACQUISITION WORKFORCE Final Report
G. B. Kipp *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 90-94 (For primary document see N84-23293 13-81)
(AD-P002762) Avail: NTIS HC A24/MF A01 CSCL 15/5

Who is the Leader in the Army Acquisition Workforce? I think most of us involved in any federal procurement process know that individual is the Contracting Officer (KO). In this article, first in the Introduction I will summarize how the Defense Acquisition Regulation (DAR) and the Army Procurement Procedure (APP), define a KO, how he is selected, his required qualifications, and major responsibilities. After the DAR and APP summaries, in the Text of the Paper I will point out a number of weaknesses I see in the present system and then make personal Recommendations for Improvement. In the Conclusions I will synopsize the benefits that can result from the overall upgrading of the KO position. Author (GRA)

N84-23310# Air Force Space Div., Los Angeles, Calif.
PREREQUISITES FOR THE ESTABLISHMENT OF A PROFESSIONAL ACQUISITION WORKFORCE Final Report
J. D. Krieger *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 95-98 (For primary document see N84-23293 13-81)
(AD-P002763) Avail: NTIS HC A24/MF A01 CSCL 15/5

Government, Industry, and Academe can make and are making great strides toward establishing a professional acquisition workforce. Prerequisite to achieving that goal is that each component do everything it can individually as well as collectively. Presently, there are tremendous barriers to establishing a professional work force and an additional danger of losing ground already gained. Too much is made of some gains that on the surface appear significant. However, by working together the goal of a professional workforce can be achieved, but failing to work together will keep it beyond grasp. Author (GRA)

N84-23311# Army Armament Munitions and Chemical Command, Rock Island, Ill.
TRAINING REQUIREMENTS FOR CHANGING TIMES Final Report
G. T. Nikolas *In* AF Business Research Management Center Proc. of the Fed. Acquisition with Theme 1983 p 99-104 (For primary document see N84-23293 13-81)
(AD-P002764) Avail: NTIS HC A24/MF A01 CSCL 15/5

Federal Managers in the procurement career series have become concerned that there appears to be a need to increase the skill level in career field. The Office of Personnel Management has demonstrated a perception of the procurement career field, as less professional and more administrative in nature, by their efforts in revising the job standards. This perception and current events highlight the subject matter of this paper. The author utilizes data researched from the Federal Acquisition Institute on the educational level of the Government procurement careerist to arrive at his conclusions. The statistical data is supplemented by discussions conducted with industry and Government leaders during recent National Contract Management Association (NCMA) meetings and symposiums. The author makes certain recommendations to improve the overall development of the procurement career professionals. Author (GRA)

N84-23312# Dayton Univ., Ohio.
A DYNAMIC PERSONNEL ASSIGNMENT MODEL IN THE R AND D ENVIRONMENT Final Report
P. J. Sweeney *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 105-107 (For primary document see N84-23293 13-81)
(AD-P002765) Avail: NTIS HC A24/MF A01 CSCL 05/1

This computer simulation captures the contributions of inexperienced and experienced personnel to overall effectiveness in a typical research and development organization. The model is appropriately responsive to changes in experience, level, Systems Program Office (SPO) leadership, priority, funding, and other factors. Given a fixed number of total personnel authorizations and fixed percentage of inexperienced personnel, the model indicates that assigning the inexperienced to the lower priority SPOs results in a maximum organizational measure of effectiveness (MOE). It also shows that an assignment policy based upon both priority and funding level may have only small impact upon this high MOE. Similarly, assigning all of the inexperienced to the high priority SPOs results in a relatively low MOE. Improving the SPO leadership increases the value of the MOE, but cannot compensate for high percentages of inexperience. The model can also be used to assign SPO leaders. Author (GRA)

N84-23313# Oklahoma City Air Logistics Center, Tinker AFB, Okla.
TRAINING ACQUISITION PERSONNEL THROUGH A LOCAL COLLEGE Final Report c80
E. R. Watters and H. A. Main *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 108-110 (For primary document see N84-23293 13-81)

(AD-P002766) Avail: NTIS HC A24/MF A01 CSCL 15/5

There are two important keys to effective and cost conscious acquisition of goods and services for the Air Force: The first is a work force trained in current acquisition skills; the second is a reservoir of qualified people for entry into the acquisition career field. To enlarge the pool of qualified people and to provide training opportunities for people in the career field, our Directorate initiated action to establish an Associate Degree Program in Purchasing and Contracting at Oscar Rose Junior College. The program is now in being and a number of our people, both clerical and professional, are attending classes offered through this program. Author (GRA)

N84-23314# Air Force Business Research Management Center, Wright-Patterson AFB, Ohio.

COST ACCOUNTING STANDARDS: A TIME FOR GOVERNMENT AND INDUSTRY ACTION Final Report

P. D. Sullivan *In its* Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 112-117 (For primary document see N84-23293 13-81)

(AD-P002767) Avail: NTIS HC A24/MF A01 CSCL 15/5

From its inception in 1970, the Cost Accounting Standards Board (CAS Board) was the subject of considerable controversy. In September 1980, Congress declined to continue funding of the Board and it ceased operations. But the nineteen Standards promulgated by the Board continue today as a part of the law. Consequently government and industry alike have found themselves without an authoritative body to interpret the Standards and issue corrections, exemptions and waivers. This paper will examine the history of the Board, some of the current problems, and discuss several of the alternatives that are available at this time for dealing with the situation created by the demise of the Cost Accounting Standards Board. GRA

N84-23315*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

GOVERNMENT - CONTRACTOR INTERACTION Final Report

D. M. Thomas *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 118-121 (For primary document see N84-23293 13-81)

(AD-P002768) Avail: NTIS HC A24/MF A01 CSCL 15/5

The development of the Administrative Contracting Officer represents an advance in the Government system of contract management because it provides an individual with knowledge, time, and a specialized function to insure performance of Government contracts. However, the development has created a dichotomy between the award and the post-award function which increases the adversary relationship with Government contractors. This paper advocates that this adversary relationship can be decreased if PCOs and ACOs are provided with opportunities to serve in the assignments of the other. Author (GRA)

N84-23316# Air Force Business Research Management Center, Wright-Patterson AFB, Ohio.

NEEDED HELP FOR THE FEDERAL ACQUISITION REGULATION COUNCIL Final Report

C. D. Woodruff *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 122-127 (For primary document see N84-23293 13-81)

(AD-P002769) Avail: NTIS HC A24/MF A01 CSCL 15/5

Writing and maintaining of the FAR regulation will be a tough job as it has been with the DAR. The subjects covered will be complex and technical. All available capabilities should be brought to bear in the process if regulations which are fair, which can be administered economically and which effectively accomplish their purposes are to be achieved. Discussion of a few aspects of DAR 1-324 Warranties and DAR 1-330 Contractor Liability for Damage to Government Property and the related contract clauses shows the two coverages to be deficient in many aspects. A need particularly for more and earlier assistance from industry in the writing of regulations is indicated. The experience and expertise of industry personnel should supplement that of the government personnel who will be rotated in and out of the FAR Council. A document with the impact the FAR will have deserves full use of available talent. Author (GRA)

N84-23317# Logistics Management Inst., Washington, D. C.

ANALYSIS OF INCENTIVES FOR PRODUCTIVITY-ENHANCING INVESTMENT Final Report c83

G. Gottschalk, M. G. Myers, and M. J. Konvalinka *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 130-134 (For primary document see N84-23293 13-81)

(AD-P002770) Avail: NTIS HC A24/MF A01 CSCL 15/5

There is evidence that Government contractors perform production contracts using high-cost methods leading to higher than necessary prices to the Government. Capital investments which lower total cost of performance are discouraged or at least not encouraged by current policies and market environment. This paper describes a model of contractor investment behavior within existing DoD contracting principles. A preference for investments which confer low rates of productivity gain is shown to exist under current contracting policies. A discounted cash flow investment analysis model is used to explore a number of correctives to current policies including increased weight on facilities capital employed in Department of Defense (DoD) profit policy, sharing of cost savings, and investment incentives such as accelerated depreciation. Finally, the payoff to the Government and DoD if each corrective were adopted is explored. Author (GRA)

N84-23318# Office of the Under Secretary of Defense for Research and Engineering, Washington, D. C.

THE INDUSTRIAL MODERNIZATION INCENTIVES PROGRAM: AN EXPERIMENTAL EFFORT TO IMPROVE DEFENSE CONTRACTOR PRODUCTIVITY Final Report

A. D. Reeves *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 135-142 (For primary document see N84-23293 13-81)

(AD-P002771) Avail: NTIS HC A24/MF A01 CSCL 15/5

This paper concentrates on the philosophy and concepts behind the current test of Industrial Modernization Incentives Program (IMIP). The paper discusses how the test has been structured and applications to date. The test program is still in the early stages and the paper stresses that there are currently many more questions than answers. The aspects requiring further analysis are explored in detail. The paper also ties together other areas that relate to the IMIP and encompass the total environment motivating contractor productivity improvement efforts. These include Weighted Guidelines, Cost Accounting Standards, employee productivity incentive and bonus systems, multiyear procurement, economic production rates, the source selection process, and manufacturing technology. Author (GRA)

N84-23319# Iowa State Univ. of Science and Technology, Ames. Center for Industrial Research and Service.

THE GOVERNMENT RELATIONSHIP TO INDUSTRY IN TECHNOLOGY TRANSFER AND DEVELOPMENT Final Report c85

D. H. Swanson *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 143-148 (For primary document see N84-23293 13-81)

(AD-P002772) Avail: NTIS HC A24/MF A01 CSCL 05/1

Iowa State University's Center for Industrial Research and Service conducted a survey of manufacturers in January 1982. This mail survey to the 3,764 manufacturers in Iowa was designed to reveal the problem areas and information needs manufacturers and processors. The survey also addressed information sources, technology development, productivity improvement, and how managers expected to improve operations. The role of government, government laboratories, universities, equipment manufacturers, and trade associations in technology transfer and development was delineated in the analysis. GRA

N84-23320# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.

COMPETITIVE PROCUREMENTS: THE SYNERGISTIC LINKAGE AMONG GOVERNMENT, INDUSTRY AND ACADEME Final Report

D. L. Brechtel, E. J. Brost, and S. J. Zamparelli *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 150-155 (For primary document see N84-23293 13-81)
(AD-P002773) Avail: NTIS HC A24/MF A01 CSCL 15/5

Competition is looked upon by many as one technique to maximize the return from the procurement dollars available. Many members of Congress recommend the competitive method of purchasing for most Government procurement actions. However, the history of Federal procurement attests to the fact that competitive bidding is inadequate in some situations. Since competitive procurement does not always result in lower prices, program managers, contracting officers, and buyers should understand the conditions which may affect prices and aggressively seek competition for items that may likely result in net savings to the Government. This paper includes a summary of competition theory and recent research conducted in the area of competition by graduate students at the Air Force Institute of Technology (AFIT). Two graduate research projects that addressed competition for weapon system replenishment spare parts are summarized in the paper followed by some concluding observations.
Author (GRA)

N84-23321# Air Force Systems Command, Wright-Patterson AFB, Ohio.
COMPETITION: AN INTEGRAL PART OF THE ACQUISITION PROCESS Final Report
R. C. Head *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 156-160 (For primary document see N84-23293 13-81)
(AD-P002774) Avail: NTIS HC A24/MF A01 CSCL 15/5

The concept of competition for defense acquisition is one that requires careful examination and discussion in today's cost conscious environment. The Office of Management and Budget Circular A-109 directs each government agency to... depend on, whenever economically beneficial, competition between similar or differing system concepts throughout the acquisition process. This direction leads to the current high level attention that competition is receiving today. Competition is being examined as a major factor in cost control for weapon system procurement for the entire acquisition process. The need for complete preplanning and market research to promote effective competition is apparent when past procurement efforts are examined. Preplanning and market research in the early stages of the acquisition process are areas that need active management support. Author (GRA)

N84-23322# Analytics, Inc., Dayton, Ohio.
INCREASING SPARES COMPETITION IN AFLC (AIR FORCE LOGISTICS CENTER) Final Report
T. M. McCann and J. R. Butterworth *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 161-166 (For primary document see N84-23293 13-81)
(AD-P002775) Avail: NTIS HC A24/MF A01 CSCL 15/5

This paper describes the results of a research effort sponsored by the Air Force Business Research Management Center at Wright Patterson AFB. The focus of the research was on the identification of the impediments to competitive spares acquisition and definition of those actions which can be taken to improve the capability of Air Force to achieve competition on spare parts. The effort included an extensive search of the literature and field visits to Air Logistics Centers involved with the purchase of spare parts. The research was structured around analysis of the impact of the Procurement Method Code on the competitive activities. The results of the research is a set of recommendations covering systemic changes in the initial system acquisition process and in the procedures used at the Air Logistics Centers in item screening and contracting which should provide the capability to improve the degree of attained competition for Air Force spare parts. Author (GRA)

N84-23323# Virginia Univ., Charlottesville.
AWARD FEE CONTRACT PROVISIONS AS A PROGRAM MANAGEMENT TOOL Final Report
R. F. DeMong *In* AF Business Research Management Center Proc. of the Federal Acquisition Res. Symp. with Theme 1983 p 168-174 (For primary document see N84-23293 13-81)
(AD-P002776) Avail: NTIS HC A24/MF A01 CSCL 15/5

Award fee contract provisions can be used as a program management tool. Award fee contracts have been found to be a cost effective means of encouraging contractors to surpass the specifications of the contract. Award fee contracting can be successfully used in the dynamic environment of R and D programs as well as full scale development programs. Award fee contracting relies on other forms of motivation than just the profit motive. The frequent evaluations used in award fee contracting give the contractor (including its managers and employees) timely feedback on its performance. These evaluations implicitly tell the contractor what the government's priorities are. This evaluation process also enables the government to better define its requirements. It serves as a motivation tool in that the managers will strive to make the evaluation look as good as possible. Timely and high level government involvement have been found to be important in the success of award fee contracting. Author (GRA)

N84-23324# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
NAILING DOWN THE LIABILITY ISSUE ONCE AND FOR ALL Final Report **c84**
W. C. Pursch *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 175-183 (For primary document see N84-23293 13-81)
(AD-P002777) Avail: NTIS HC A24/MF A01 CSCL 15/5

This paper contrasts the present Defense Acquisition Regulation requirements for liability determinations for loss, damage, or destruction of government property in the hands of contractors, with new guidance in the Federal Acquisition Regulation for property administrators and administrative contracting officers. Discussion includes the cumbersome method of shifting the liability for loss, damage, or destruction of government property by disapproving the contractor's property control system, and the liability clauses used in government contracts. The rationale behind the government's position as a self-insurer is presented, along with the procedure to follow in making liability decisions. Finally, certain conclusions are drawn with respect to strengthening the function of the property administrator, and the need for the support of the administrative contracting officer. Author (GRA)

N84-23325# Defense Contract Administration Services, Boston, Mass.
DOES THE PROMPT PAYMENT ACT INSURE TIMELY CONTRACT PAYMENT? Final Report **c84**
M. E. Wilson *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 179-180 (For primary document see N84-23293 13-81)
(AD-P002778) Avail: NTIS HC A24/MF A01 CSCL 15/5

On 21 May 1982, President Reagan signed Public Law 97-177, the Prompt Payment Act, which has an objective of timely contract payment. Since the Act was implemented nearly one year ago, the question is: Does the Prompt Payment Act Insure Timely Contract Payment? This report addresses this question. GRA

N84-23326# Notre Dame Univ., Ind.
THE MAKE OR BUY DECISION--ITS NATURE AND IMPACT Final Report
J. G. Beverly, F. J. Bonello, J. Daschbach, and W. I. Davisson *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 185-187 (For primary document see N84-23293 13-81)
(AD-P002779) Avail: NTIS HC A24/MF A01 CSCL 15/5

There is no contractor at this time, in this Nation who can fabricate all the components needed for a major weapons system and deliver it in the time required and within cost limits. Therefore, the prime contractor must subcontract out certain of the components and parts needed for the system assembly. How do contractors make this division regarding the components and parts to be made versus those to be bought? This paper reviews the background for this area providing the theory and the practices

as found during a recent study for the Air Force Business Research Management Center. Author (GRA)

N84-23327# Naval Air Systems Command, Washington, D. C.
MULTI-YEAR PROCUREMENT A 'TEAM APPROACH' Final Report
H. S. Fromer and J. L. Sweeney *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 188-192 (For primary document see N84-23293 13-81)
(AD-P002780) Avail: NTIS HC A24/MF A01 CSCL 15/5

Teamwork, as demonstrated by Congressional actions to alter the laws, DoD's management and policy initiatives, the services requirements and funding planning and contractors and subcontractors productivity and risk assumption efforts has yielded better than expected results in the application of the Multi-Year Procurement Initiative Government, while recognizing that multi-year does not fit all programs, is realizing better than projected savings on the programs that have been selected for multi-year. Industry has found that an aggressive multi-year approach can stabilize employment, aid in their modernization programs and increase the efficiency of their existing operations. Everyone has found that the rewards have far exceeded the risks and it remains for Congress to determine whether it can overcome its penchant for year to year adjustments and take a long term view of defense procurement so that the scope of the multi-year application can grow beyond its present foothold. Meanwhile, Multi-Year Procurement, the 1980's version, is providing all the expected benefits by driving unit costs down, while improving our defense industrial base and putting people back to work, truly a initiative for our times. GRA

N84-23328# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
COST RISK AND CONTRACT TYPE: A NORMATIVE MODEL Final Report
R. L. Murphy *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 193-197 (For primary document see N84-23293 13-81)
(AD-P002781) Avail: NTIS HC A24/MF A01 CSCL 15/5

This article presents a model which describes the relationships among the cost risk inherent in a particular procurement situation, the degree to which that cost risk is shared between the government and the contractor, and the risk premium awarded to the contractor for assuming his share of the cost risk. The model is normative in that it provides a framework for analyzing the possible combinations of risk assumption on the part of the government and risk premiums which are logically consistent. The model requires that the price analyst estimate the cost of contract performance, the general shape of the distribution of probable costs, and the standard deviation of that distribution. In addition, a policy decision is required concerning what constitutes a reasonable probability that the contractor would incur a loss. Author (GRA)

N84-23329# Air Force Armament Lab., Eglin AFB, Fla.
CONTRACTING INITIATIVE: BEST PROPOSAL FOR PRICE Final Report
B. Rose *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 198-201 (For primary document see N84-23293 13-81)
(AD-P002782) Avail: NTIS HC A24/MF A01 CSCL 15/5

With ever increasing emphasis being placed on Department of Defense acquisition improvements and reduction of acquisition lead time, the Air Force Systems Command, Armament Division, has developed and is testing a contracting initiative referred to as Best Proposal for Price. This concept is intended to significantly reduce efforts by government and contractor personnel and thereby reduce acquisition lead time while maintaining the integrity of competitions that are limited by funds. Best Proposal for Price contemplates award without negotiation, if possible. The main thrust of this acquisition concept is to identify the government's maximum contract dollar amount in the solicitation thus minimizing the negotiation processing time and yet insuring technical performance. Offering potential for improving present negotiation contracting procedures, the very nature and structure of Best Proposal for Price lends itself to some controversy. Nevertheless, Best Proposal for Price has the intrinsic momentum to be highly contributory in government contracting strategy. Author (GRA)

N84-23330# VTI, Inc., Dayton, Ohio.
A COST BASED ACQUISITION PLANNING MODEL UTILIZING EXPERT SYSTEM CONCEPTS Final Report
M. A. Bucciarelli and G. L. Roeder *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 202-208 (For primary document see N84-23293 13-81)
(AD-P002783) Avail: NTIS HC A24/MF A01 CSCL 15/5

A micro-processor based computer model utilizing expert system concepts has been developed to provide cost based acquisition planning information to the DoD acquisition community. The model, called ACROM, is a menu driven inquiry-response system wherein qualitative acquisition profile descriptions are converted, via embedded algorithms, to quantitative system acquisition cost estimates in a MIL-STD-881A Work Breakdown Structure format. The choice of one of two input modes provides for a top-down (Mode A) estimate using only six high level input parameters or a bottom-up (Mode B) estimate by characterizing each of 45 WBS elements for the system acquisition. Estimates may be accumulated by subsystem for large scale programs or by phase for total program and/or life cycle cost estimates. The model has been exercised for over 70 DoD system acquisitions and has provided relatively accurate estimates for electronic computer-based systems. It is anticipated that continued use and enhancements of the model will improve the embedded expertise in specialized acquisition areas and will provide a readily accessible and easy to use program management support tool in the critical area of system cost. Author (GRA)

N84-23331# Bedford Research Associates, Mass.
COMPUTER GENERATED ACQUISITION DOCUMENT SYSTEM (CGADS) Final Report c60
S. F. OShaughnessy and G. L. Roeder *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 209-213 (For primary document see N84-23293 13-81)
(AD-P002784) Avail: NTIS HC A24/MF A01 CSCL 15/5

The Computer Generated Acquisition Document System (CGADS) is a computer program written in F77 (version of FORTRAN 77) through which draft Statements of Work (SOW) and Contract Data Requirements Lists (CDRL) for weapon systems acquisitions may be created. CGADS was developed by the Electronics Systems Division at Hanscom Air Force Base, Massachusetts, to provide automated assistance to project/procurement offices in the development of acquisition documentation for inclusion in solicitations and Request for Proposals (RFPs). This paper describes the current version of the operational CGADS. Author (GRA)

N84-23332# American Inst. for Research, Bedford, Mass.
COMPUTER AIDED SOURCE SELECTION (CASS) Final Report c60
G. L. Roeder *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 214-216 (For primary document see N84-23293 13-81)
(AD-P002785) Avail: NTIS HC A24/MF A01 CSCL 15/5

The source selection process in the Department of Defense is a labor intensive effort which ties-up the management, technical, and administrative resources of acquisition agencies on a continuing basis. The CASS series of prototype computer programs have been developed with the objective of providing automated aids to facilitate the conduct and management of the source selection process. It is anticipated that the following benefits can accrue with the use of CASS by the DoD: Shorten the time required for source-selection decisions; Reduce the manpower supporting proposal evaluations for both the Government and Industry; Improve traceability of evaluation findings to contractor selection;

Serve as a training aid to new and inexperienced evaluators; Provide more flexible decision support tools; Reduce the administrative burden of documenting the source-selection; and Facilitate a lessons learned data base. GRA

N84-23333# University of Southern California, Los Angeles.
AN APPLICATION OF THE CAUSAL-INTEGRATIVE MODEL Final Report
I. A. Somers and P. C. Gardiner *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 217-221 (For primary document see N84-23293 13-81)
(AD-P002786) Avail: NTIS HC A24/MF A01 CSCL 15/5

Historical analyses of program acquisitions indicate that the probability of cost growth and/or schedule slippages is high. Many research efforts have been directed at identifying the causal factors leading to these changes in program performance. Much of the research has been devoted to modeling the acquisition process with the goal being a more effective control of program performance. A common observation of researchers is that the acquisition process is a complex and interrelated set of events. As such, any comprehensive model that claims to represent this process must reflect these interrelated activities, many of which can be described by feedback loops. This paper discusses one such model that utilizes the Systems Dynamic approach to simulation to portray the processes that form collectively the program acquisition cycle. The Causal-Integrative Model (CIM) was just presented in its conceptual form at the Management of Risk and Uncertainty Symposium in February, 1981, at the U.S. Air Force Academy, Colorado. This paper reports on the computer-based operational form of the CIM. The results of applying the computerized model to one acquisition program are presented.
Author (GRA)

N84-23334# Clemson Univ., S.C.
AN AUTOMATED AIRFRAME PRODUCTION COST MODEL Final Report
N. K. Womer *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 222-228 (For primary document see N84-23293 13-81)
(AD-P002787) Avail: NTIS HC A24/MF A01 CSCL 15/5

This paper is dedicated to developing a better understanding of the factors and forces that determine weapons system cost during production. Here we report on a tool that provides timely estimates of the cost impacts of program policy decisions. This tool was developed from theoretical principles. The economists production function was incorporated into a model which addressed the realities of program management. The model uses the calculus of variations to include the production cost drivers of learning by doing, learning over time, the speed of the production line and production line length. It is estimated from data on the C-141 program and tested on other Air Force programs. This work is fully documented in Cost Functions for Airframe Production Programs a report prepared for the Air Force Business Research Management Center and the Office of Naval Research by Womer and Gulledge. This paper concentrates on the results and applications of that study. Author (GRA)

N84-23335# PEL, Inc., Baton Rouge, La.
RISK ANALYSIS: COMPARING DIFFERENT CONTRACT TYPES Final Report
G. Worm *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 229-231 (For primary document see N84-23293 13-81)
(AD-P002788) Avail: NTIS HC A24/MF A01 CSCL 15/5

This paper presents a brief description of how the results from a cost risk analysis can be used to distribute the risk in a contract between the government and the contractor. The main contract types discussed are Firm Fixed Price (FFP) and Fixed Price Incentive (FPI). Other contract types may be structured around a risk analysis but are not discussed here. GRA

N84-23336# Defense Systems Management School, Fort Belvoir, Va.
MANAGING FOR SUCCESS IN DEFENSE SYSTEMS ACQUISITION Final Report
J. S. Baumgartner, C. Brown, and P. Kelley *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 233-238 (For primary document see N84-23293 13-81)
(AD-P002789) Avail: NTIS HC A24/MF A01 CSCL 15/5

This study, an offshoot of a DoD cost growth study, was conducted to identify elements common to successful programs, programs that met most of their cost, schedule, and performance goals, and worked well when fielded. Key government and industry officials of twelve successful programs were interviewed to find out how success is measured and what impact various forces had on the success of these systems. The primary measure of success is that the system worked well when fielded. Main elements of a successful program are stability, realistic requirements, good people, good leadership and, particularly, confidence and teamwork between the program office and the contractor. The PM's tenure, pushing the state-of-the-art in technology, and meeting the requirements of regulations and directives have little impact on the success of a program. Outside influences are, on balance, helpful. The people we interviewed enjoyed their jobs and the challenges of program management. One program manager said it was the finest job he ever had--high risk, high rolling. A Navy PM said it was the closest thing ashore to the command of a ship. Author (GRA)

N84-23337# Department of Energy, Richland, Wash. Operations Office.
NUCLEAR REACTOR: ON SCHEDULE AND UNDER COST Final REport
R. D. Larson *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 239-242 (For primary document see N84-23293 13-81)
(AD-P002790) Avail: NTIS HC A24/MF A01 CSCL 15/5

The National Society of Professional Engineers has named the Fast Flux Test Facility (FFTF), an experimental nuclear reactor cooled by molten sodium, one of the nation's ten top engineering achievements of 1982. The reactor is located at Richland, Washington. In the early 1970's, there were serious concerns whether the reactor would ever be built because of cost overruns, schedule slippages, design changes and a general lack of confidence in control of the project. Several major management actions were taken to assure that the design-construction project was completed within the cost and schedule re-established by Congress in 1975. The major management tool used to incentivize the design-construction contractor and assure completion of the project within the new schedule and budget was the cost plus award fee, cost plus incentive fee contractual arrangement developed for this project. GRA

N84-23338# Oklahoma City Air Logistics Center, Tinker AFB, Okla.
RESHAPING THE PHILOSOPHY OF SPARE PARTS ACQUISITION: PROJECT PACER PRICE Final Report
G. Leininger *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 239-242 (For primary document see N84-23293 13-81)
(AD-P002791) Avail: NTIS HC A24/MF A01 CSCL 15/5

On June 1st, 1983, a new program called PACER PRICE began operation at the Oklahoma City Air Logistics Center. Staffed by an interdirectorate group of engineers, manufacturing planners, price analysts and packaging specialists, the program was designed as a thorough and comprehensive review process to determine optimum purchase method and price for every actively-purchased replenishment spare part managed at the Center. After three months of program operation, approximately 62 percent of the sole-source items have been recommended for competitive purchase, and the prices recommended for these items average about 35 percent below the latest contract prices adjusted for quantity and inflation. But beyond that, a new Philosophy of

spare parts purchase has been formulated and effected as a procedural caveat: All spares should be both purchased competitively and PRICED TO CONFORM WITH COMPETITIVE-MARKET PRICES. The paper focuses on this philosophy, detailing in particular the mathematical models used to simulate competitive prices, and offers suggestions for further research into the competitive market place. Author (GRA)

N84-23339# Management Consulting and Research, Inc., Falls Church, Va.
THE PROBLEM OF COST GROWTH Final Report c83
G. R. McNichols and B. J. McKinney *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 251-254 (For primary document see N84-23293 13-81)
(AD-P002792) Avail: NTIS HC A24/MF A01 CSCL 15/5

There is a substantial amount of rhetoric on the subject of cost growth. Usually, we blame such growth on inflation. There are, in fact, several views on the reasons for cost growth or the measures used to calculate and present cost increases by weapon system. MCR has conducted studies of cost growth for many years. This particular paper will discuss the problem from an historical perspective, and present actual results from an analysis of the 31 December 1982 Selected Acquisition Reports (SARs). GRA

N84-23340# Advanced Technology, Inc., Arlington, Va.
ECONOMIC PRODUCTION RATE STUDY Final Report c83
E. J. Downing, Jr., G. E. Roesler, and W. M. McGovern *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 256-261 (For primary document see N84-23293 13-81)
(AD-P002793) Avail: NTIS HC A24/MF A01 CSCL 15/5

The objective of this study is to give the Program Manager tools for use in discussing, planning and evaluating economic production rates. In order to deal with large scale, multi-tiered acquisition programs, a distinction must be made between procurement and production rate. The economic procurement rate refers to the rate of acquisition of the complete system, while the economic production rate addresses each component or contractor contributing to the system. The EPR is defined as that rate of procurement (or production) that permits efficient use of available industrial resources to achieve the lowest unit cost. Using a model suggested by John Bemis, this study examines the procurement profile of five major DoD acquisition programs--the Army's M-1 tank, Fighting Vehicle System and TOW missile, the Air Force's A-10 aircraft, and the navy's A-6E aircraft. The model can be expressed either graphically or as an exponential equation. The graphical form is especially useful when iso-unit cost lines are plotted on axes of production rate versus cumulative quantity. In this form it is possible to evaluate various procurement profiles of a system and draw some conclusions concerning their relative efficiencies. This analysis was done for each of the five systems, and savings from more economical rates are estimated. GRA

N84-23341# Ohio State Univ., Columbus.
EXPERT SYSTEMS FOR PRICE ANALYSIS: A FEASIBILITY STUDY Final Report c83
J. F. Dillard, K. Ramarkrishna, and B. Chandrasekaran *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 270-274 (For primary document see N84-23293 13-81)
(Contract F33615-82-C-5114)
(AD-P002795) Avail: NTIS HC A24/MF A01 CSCL 15/5

The feasibility of alternative designs for an expert price analysis computer system is evaluated by analyzing the price analysis task, and the related support requirements, as performed by Air Force procurement activities. Generally, the Air Force should embark on a coordinated, long-range program of providing adequate expert system support to all procurement functions. Initially, this support can best be provided by a highly structured, interactive expert system which confronts the system user with requisite decision sequences. Each sequence points to a tutorial network which provides explanation and instruction if desired. The most immediate benefit will be experienced at the base level where little expert assistance is currently available. This type of expert system provides the nucleus for developing more sophisticated expert systems for other procurement activities in the intermediate and long term. Author (GRA)

N84-23342# Naval Postgraduate School, Monterey, Calif.
CONTRACTOR 'HUNGRINESS' AND THE RELATIVE PROFITABILITY OF DOD BUSINESS Final Report c83
W. R. Greer, Jr. and S. S. Liao *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 275-279 (For primary document see N84-23293 13-81)
(AD-P002796) Avail: NTIS HC A24/MF A01 CSCL 15/5

Lately, DoD-contractor profitability has been very much an issue. Some feel low profits may convert defense business into a market of last resort. Others allege defense contractors earn excessive profits. We address the contradiction between these viewpoints. Specifically, we examine data covering 20 years, and study how the profitability of DoD contracts is influenced. We ask how profitable contractors are in their DoD versus commercial business segments, and whether the risk levels faced are equivalent. Our conclusions are that Program Managers (PM's) take advantage of the bargaining power they hold to buy goods at substantially lower profit margins when capacity utilization is low. The returns earned by contractors on DoD business are measurably lower than the returns on commercial business during periods of low capacity utilization. Also, the volatility of returns is higher for Dod business which means the risks are viewed by management as being somewhat higher. Author (GRA)

N84-23343# Management Consulting and Research, Inc., Falls Church, Va.
INDEPENDENT COST ESTIMATES: A CASE STUDY JOINT VERTICAL LIFT AIRCRAFT (JVX) PROGRAM Final Report c83
G. R. McNichols and G. L. Sorrell *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 280-283 (For primary document see N84-23293 13-81)
(AD-P002797) Avail: NTIS HC A24/MF A01 CSCL 15/5

In 1982, the Army was intrigued with a concept known as the Joint Vertical Lift Aircraft (JVX). Because of the nature of the program, an Independent Cost Estimate (ICE) was performed to double check the Program Office estimate. While the Army appears to have lost some interest in the program, this cost study illustrates the process of independent cost estimating. Author (GRA)

N84-23344# Ohio State Univ., Columbus.
AN INTELLIGENT MANUAL FOR PRICE ANALYSIS Final Report c83
K. Ramakrishna, J. F. Dillard, T. G. Harrison, and B. Chandrasekaran *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 284-290 (For primary document see N84-23293 13-81)
(Contract F33615-82-C-5114)
(AD-P002798) Avail: NTIS HC A24/MF A01 CSCL 15/5

We investigated price analysis as performed in the United States Air Force (USAF) and the environment in which buyers at bases make decisions about procurement actions. Based on this study, we evaluated the intelligent manual approach for guiding a buyer through the decisions and actions necessary to conclude a buy. An intelligent manual is a computer-based consultant that provides advice and pointers on the use of existing information in response to user queries. Our prototype intelligent manual is constructed as part of the ZOG system. ZOG is an active, large-network, menu-selection system. We present the design of the interactive intelligent manual (based on our analysis of pricing) and discuss its short-term and long-term implications for procurement in the USAF. We identify how this system would be the basis for future intelligent, problem-solving expert systems that automate significant components of the pricing task. GRA

N84-23345# Delaware Univ., Newark.
ON 'BEFORE' AND 'AFTER' COST COMPARISONS Final Report c83
R. M. Stark *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 291-293 (For primary document see N84-23293 13-81)
(AD-P002799) Avail: NTIS HC A24/MF A01 CSCL 15/5

Comparisons of a priori cost estimates with a posteriori payments is about as pervasive as it is instinctive. A new result of mathematical optimization and probability theories leads to the unexpected conclusion that such comparisons, even for many idealized engineering designs, appear to be invalid. The paper demonstrates that before and after costs are unit samples from populations with different probability distributions. GRA

N84-23346# Science Applications, Inc., McLean, Va.
COST REALISM: ASSURING MORE REALISTIC CONTRACTOR COST PROPOSALS Final Report c83
D. L. Trapp *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 294-300 (For primary document see N84-23293 13-81)
(AD-P002800) Avail: NTIS HC A24/MF A01 CSCL 15/5

Unrealism in Defense contractors' cost proposals, especially for RDT&E programs, often contributes to cost growth as well as to other problems. The Defense Department is therefore concerned with achieving greater cost realism. A methodology has been developed for achieving greater realism of contractor cost proposals. This methodology defines cost realism as an evaluation criterion stated in the solicitation which compares the offeror's proposed cost with a detailed Government estimate for each contractor and then scores of the degree of realism. The methodology constitutes a source selection cost evaluation process involving determination of cost evaluation factors; preparation of instructions to be included in the solicitation concerning the cost evaluation factors; preparation of Government estimates for each offeror; and scoring each offeror for cost realism and Government estimated cost. The methodology is a synthesis and improvement of the best techniques and procedures currently being used in source selection cost evaluation (especially those of NAVELEX). Author (GRA)

N84-23347# Pratt and Whitney Aircraft Group, East Hartford, Conn.
IMPACT OF CORPORATE RESOURCE ALLOCATION DECISIONS ON NATIONAL SECURITY OBJECTIVES: DISSYNERGISM IN AEROSPACE INDUSTRIAL RESOURCE PLANNING Final Report
O. M. Collins *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 302-315 (For primary document see N84-23293 13-81)
(AD-P002801) Avail: NTIS HC A24/MF A01 CSCL 15/5

The purpose of the proposed paper is to assess the impact of corporate resource allocation decisions in the US aerospace industry on long-term national-security objectives. The data presented demonstrates the dissynergy that exists in one critical area of national interest as the result of inconsistencies between corporate and defense strategic resource planning objectives. The DoD Industrial Base and Preparedness Program will be evaluated as a basis for creating a credible defense industrial resource planning system to parallel existing force and technology planning systems; and, integrating corporate and defense long-range planning objectives. Based on the analysis, a recommended policy and organizational approach is presented in terms of the following parameters: acquisition efficiency and industrial preparedness. GRA

N84-23348# Air Force Armament Lab., Eglin AFB, Fla.
TWO-STEP INDUSTRIAL PREPAREDNESS PLANNING: BALANCING FUNDS AND PRODUCTION CAPABILITY Final Report
K. B. Johnson *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 316-319 (For primary document see N84-23293 13-81)
(AD-P002802) Avail: NTIS HC A24/MF A01 CSCL 13/8

The Industrial Preparedness Planning program provides data relative to the capability of the production base to accelerate and expand production during a national emergency. Planning data also includes identification of Industrial Preparedness Measures (IPMs) which can be funded during peacetime to compress production build-up time. However, determining what IPMs to fund can be difficult since: Build-up times for components of end-item weapons vary by substantial margins; and Available funding is usually inadequate. This difficulty could be minimized by adjusting IPM data for pacing components to correspond to a common build-up time based on an affordable funding level. Formalizing the adjustment of IPM data in this manner as a second step in the Industrial Preparedness Planning process would facilitate effective prioritizing of peacetime funding for IPMs. This would insure funding of only those IPMs for potential production bottlenecks to support a balanced production response capability. GRA

N84-23349# Army Armament Munitions and Chemical Command, Rock Island, Ill.
READINESS PLANNING IN A PEACETIME ENVIRONMENT Final Report
G. T. Nicolas *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 320-325 (For primary document see N84-23293 13-81)
(AD-P002803) Avail: NTIS HC A24/MF A01 CSCL 15/5

The purpose of this paper is to provide the Department of Defense (DoD) personnel and the public with information on how readiness planning in a peacetime environment will enhance the ability of DoD to respond to a Vietnam-type war, quick deployment of the Rapid Deployment Force (RDF) to a world trouble spot, or the initial phase of build-up in a mobilization situation. The paper will highlight a novel way of obtaining information and of facilitating rapid acceleration of defense contractors without the formal declaration of war or a national emergency. Author (GRA)

N84-23350# DOD Weapon Support Improvement and Analysis Office, Alexandria, Va.
POLICY INITIATIVES TO ACHIEVE READINESS AND SUPPORT OBJECTIVES Final Report
J. D. Arcieri *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 327-329 (For primary document see N84-23293 13-81)
(AD-P002804) Avail: NTIS HC A24/MF A01 CSCL 15/5

The fundamental responsibility of the Defense logistics community is to ensure the timely availability of the requisite support to enable our forces to effectively deter aggression, and should deterence fail, to successfully undertake military operations that prevent the enemy from achieving his goals at minimum war cost to the U.S. and our allies. In essence, this means the logistics community of organic and industrial capability, must ensure military force readiness and sustainability. This formidable responsibility imparts a concurrently dual-edged challenge: obtaining affordable Life Cycle Cost/effective supportable systems; and continuing improvements in the effectiveness and efficiency of our logistics systems' operations. To meet this challenge DoD has undertaken several policy initiatives to achieve more intensive and effective logistics involvement in the acquisition process. Particularly, attention has been given to changing top level acquisition policy directives and instructions, and in changes to the logistics support analysis requirements outlined in MIL-STD-1388. The purpose of these changes being to concentrate adequate management attention on the early phases of the acquisition process where the greatest influence can be made on system design characteristics. GRA

N84-23351# Army DARCOM Materiel Readiness Support Activity, Lexington, Ky.
1982 US ARMY MATERIEL DEVELOPMENT AND READINESS COMMAND (DARCOM) INTEGRATED LOGISTIC SUPPORT (ILS) STUDY FINDING ON CONTRACTING FOR ILS Final Report
D. M. Morgan *In* AF Business Research Management Center

Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 330-333 (For primary document see N84-23293 13-81)
(AD-P002805) Avail: NTIS HC A24/MF A01 CSCL 15/5

This paper gives a general overview of the objective, organization, and approach used by the 1982 DARCOM Integrated Logistics Support Study. The seven high payoff areas that the study concentrated on are listed but only the results of the solicitation documents study effort are discussed in detail. Each action item developed by the solicitation documents subgroup is discussed in detail to include a description of both the problem and recommended correction(s). Author (GRA)

N84-23352# Army DARCOM Materiel Readiness Support Activity, Lexington, Ky.
THE NEW MIL-STDS (MILITARY STANDARD) 1388 Final Report c84
J. E. Peer and D. L. McChrystal *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 334-339 (For primary document see N84-23293 13-81)
(AD-P002806) Avail: NTIS HC A24/MF A01 CSCL 15/5

The concept for Logistics Support Analysis was originally set forth in MIL-STD-1388-1 published in October 1973. Since that time each service has pursued an independent course in the applications of LSA. DoD policies and directives for Integrated Logistics Support and LSA have changed to reflect refinements to an availability of analytical techniques developed to meet state-of-the-art hardware requirements. This paper describes the latest effort to provide a standard LSA with the broadest possible application. The recently published MIL-STD-1388-1A overcomes many shortcomings that were identified with the original military standard. It defines the LSA tasks in greater detail and provides the capability to tailor the level of effort for LSA to meet the specific requirements of any given acquisition program. Also discussed is a proposed version of MIL-STD-1388-2A, DoD Requirements for a Logistic Support Analysis Record (LSAR). This document describes the data elements, definitions, and input data records for the DoD standard LSAR which is currently under development. Author (GRA)

N84-23353# Army DARCOM Materiel Readiness Support Activity, Lexington, Ky.
CENTRAL DEMAND DATA BASE (CDDB) END ITEM CODE (EIC) Final Report c82
G. Campbell *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 341-344 (For primary document see N84-23293 13-81)
(AD-P002807) Avail: NTIS HC A24/MF A01 CSCL 15/5

One of the most difficult tasks facing Army Logisticians is the accurate determination of the repair parts stockage levels to support the equipment in the hands of the soldier. Decisions on total repair parts consumption are based on demands, but repair parts for individual fielding of equipment in operational units are based upon estimates known as Failure Factors (FF's). These FF's established during the initial deployment of equipment are used throughout that equipment's life cycle. To update FF's, individual repair parts consumption must be identified to a specific end item application. The problem has been that there is no data source sufficiently reliable and valid to identify and collect data to update FF's. The End Item Code was designed to accomplish the identification and capture of individual repair parts consumption by specific end items, and provide the Army managers with an accurate record of repair parts consumption throughout the life cycle of an end item. Author (GRA)

N84-23354# Logistics Management Inst., Washington, D. C.
IMPROVED MANAGEMENT OF SUPPORT RESOURCES Final Report
D. V. Glass and D. W. Srull *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 345-350 (For primary document see N84-23293 13-81)
(AD-P002808) Avail: NTIS HC A24/MF A01 CSCL 15/5

Improving the management of support resources for major weapon systems is a crucial goal for the Department of Defense. The problem of weapon systems being inadequately supported in the field because of fragmented decision making in the allocation of support resources (e.g., spares, support and test equipment) was addressed in DoD Acquisition Improvement Initiative 30. New management procedures to help correct this problem were tested during the FY83 and FY84 budget reviews and the FY84-88 program review. In this paper we evaluate the test results in terms of the feasibility of identifying individual weapon system support resource needs, and the utility of collecting and reviewing this information during key points in the planning, programming and budgeting process. We then make several recommendations to improve the trial procedures and to move the initiative to final implementation. Author (GRA)

N84-23355# Corpus Christi Army Depot, Tex.
PROJECT: ACQUISITION STRATEGY Final Report
W. D. Majewski *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 351-354 (For primary document see N84-23293 13-81)
(AD-P002809) Avail: NTIS HC A24/MF A01 CSCL 15/5

This paper describes a concept that is being observed with skepticism and an unwillingness to change that pervades throughout the management levels of the major procurement communities. This paper will discuss the trends of the outlying smaller procurement offices that directly support production facilities in the United States Army. The growth in central procurement that is evolving haphazardly is causing confusion throughout the procurement field. The principal elements that play a major role in this concept include, but are not limited to, delivery time, lead time, and general responsiveness on the part of the government; and speculative stocking, delivery time, lead time, cash flow, and investments on the part of the contractors/sellers. All of these elements play a formidable role in the recommendation to decentralization. This paper will discuss each of these items and will provide an explanation where the elements have a staggering effect upon the readiness and hence responsiveness of the military. GRA

N84-23356# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
LARGE FIRM EFFICIENCY, CONCENTRATION, AND PROFITABILITY IN DEFENSE MARKETS Final Report
R. F. Allen *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 356-362 (For primary document see N84-23293 13-81)
(AD-P002810) Avail: NTIS HC A24/MF A01 CSCL 15/5

This paper attempts to quantify the relative impacts of large firm efficiency and market power on profit margins in defense industries. The methodology employs a direct measure of firm efficiency together with a conventional measure of market power. Large firm efficiency and the effective use of market power appear to be generally present in industries characterized by decreasing costs. However, the basic defense industries - aircraft, missiles, ordnance, and shipbuilding are notable for the absence of large firm efficiency and the absence of effective use of market power by leading firms. Author (GRA)

N84-23357# Defense Contract Administration Services, Boston, Mass.
EXPORT TRADE: BIG BUSINESS FOR THE SMALL ENTREPRENEUR Final Report
J. M. Colachico *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 363-375 (For primary document see N84-23293 13-81)
(AD-P002811) Avail: NTIS HC A24/MF A01 CSCL 05/3

Under the impetus of a widening trade deficit and recessionary economic conditions for United States businesses, Congress and President Reagan have sought to place emphasis on increased growth of international trade by removal of some of the barriers which have inhibited the entrance of businesses, particularly small and medium size corporations, into the global marketplace. This initial step, in the form of the Export Trading Company Act of 1982, has been met with caution and optimism

in the business and banking community. If maximum advantage is taken of the provisions of that legislation and a number of export trading companies are developed - independent, in-house large corporation models, and bank-owned - the benefits to American business can be substantial. GRA

N84-23358# Defense Fuel Supply Center, Alexandria, Va.
TACTICAL BUYING DECISIONS FOR STRATEGIC PETROLEUM RESERVE SPOT PROCUREMENTS: THE TUNNEL THEORY Final Report
L. C. Ervin *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 376-382 (For primary document see N84-23293 13-81)
(AD-P002812) Avail: NTIS HC A24/MF A01 CSCL 15/5

Procurement of crude oil on the spot market at minimum prices requires economic analysis which focuses on the discovery of market price levels and the determination of short-run market direction. This paper presents the results of statistical research concerning the formation of spot prices in the crude oil market. Variables suggested by the economic theory of raw material and commodity markets are investigated. The demand for incremental (spot) volumes of crude oil is found to be derived from the demand for incremental volumes of petroleum products. Insights gained from this analysis are used to establish tactical decision rules to be followed when making purchases under the provisions of the Defense Fuel Supply Center's open and continuous solicitations on behalf of the Department of Energy's Strategic Petroleum Reserve. The results of this research are also shown to be important input for strategic decisions concerning the mix and timing of spot and long-term contract procurements. GRA

N84-23359# Naval Air Rework Facility, Norfolk, Va.
NEW INITIATIVES IN INTERNATIONAL PROGRAMS Final Report
J. S. W. Fargher, Jr. *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 384-396 (For primary document see N84-23293 13-81)
(AD-P002813) Avail: NTIS HC A24/MF A01 CSCL 15/5

The paper entitled Management of Multinational Programs based upon the research results contained in the Joint Logistics Commanders' Guide for the Management of Multinational Programs developed by the author, was presented in the 1982 Federal Acquisition Research Symposium Proceedings. This paper is intended to provide an update of new initiatives developed and implemented since the paper and guide were published. Examples of two new international programs, the U.S. Army/U.S. Marine Corps Light Armored Vehicle (LAV) and the U.S. Army Advanced Attack Helicopter (AAH), are presented. The author had the privilege to serve as the Deputy Project Manager on the LAV and consultant to the AAH Program Manager to establish an international consortium for coproduction of the Advanced Attack Helicopter. Author (GRA)

N84-23360# University of Southern California, Los Angeles.
RATIONALIZATION, STANDARDIZATION AND INTEROPERABILITY: PROTECTING US INTERESTS IN THE PROCESS Final Report
J. H. Gill *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 397-403 (For primary document see N84-23293 13-81)
(AD-P002814) Avail: NTIS HC A24/MF A01 CSCL 05/1

The military necessity for Rationalization, Standardization and Interoperability increases as the possibility of a non-nuclear European war increases. The No-First-Use of nuclear weapons policy that has received considerable attention in the recent past must inevitably dictate that conventional force capabilities be significantly improved. One of the most dramatic force multipliers as it were, is the capability of all nations to utilize weapon systems that are either the same (Standardization) or at least compatible in fuel, ammunition and communication. National Security may be viewed in the context of capability and credibility. If a nation (or alliance) has no capability, the credibility of its actions is not significant. NATO has been viewed by its members a vehicle whereby the synergistic sum is greater than the sum of its parts. The viability of NATO will ultimately depend upon the willingness of the individual states to sacrifice their national interests for the advantage of projecting a combined conventional capability sufficiently credible to deter Soviet aggression. For this reason alone, a rational RSI Program must be an integral part of U.S./NATO strategic planning. GRA

N84-23361# Air Force Logistics Command, Wright-Patterson AFB, Ohio.
QUALITY ASSURANCE - AIR FORCE LOGISTICS COMMAND Final Report c38
P. Brown *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 409-410 (For primary document see N84-23293 13-81)
(AD-P002816) Avail: NTIS HC A24/MF A01 CSCL 15/5

This paper examines the scope of the Air Force Logistics Command's (AFLC) mission and focuses on current management indicators and initiatives related to Quality Assurance. The Quality Assurance discipline within AFLC is tasked with the responsibility of corporate oversight of the quality of workmanship of the commands' products, goods, and services. Since fiscal year 1976, adverse trends have been noted in frequency of customer reported defects on these weapon systems, and several innovative and dramatic steps have been taken to reverse the decline in the technical competence of our work. In February 1981, the command established a Maintenance Industrial Quality Study Group that was chartered to examine the entire spectrum of quality, with special emphasis on five major categories. The five categories were: Policy Guidance; People Programs; Technology; Investment Benefits; and Management Systems. The ultimate goal of the study was to formulate a quality effort which placed maximum emphasis on defect prevention rather than defect correction. GRA

N84-23362# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
THE AVIONICS INTEGRITY PROGRAM (AVIP) Final Report
T. J. Dickman and L. F. Cheshire *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 411-415 (For primary document see N84-23293 13-81)
(AD-P002817) Avail: NTIS HC A24/MF A01 CSCL 15/5

The Avionics Integrity Program (AVIP) is an Aeronautical Systems Division initiative to develop an orderly procedure to assure that we acquire reliable, high quality, and supportable avionics systems. A draft military standard has been prepared and has been distributed for review and comment. The draft standard outlines an orderly process using existing tools in order to assure integrity. The orderly technical process combined with an appropriate contract strategy using incentives is expected to yield the highest probability of success in achieving integrity. This paper introduces the Avionics Integrity Program (AVIP) and answers the questions often asked regarding the program. Author (GRA)

N84-23363# Defense Contract Administration Services, Cleveland, Ohio.
QUALITY AT THE CROSSROADS Final Report c38
C. R. Henry and J. C. Albini *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 416-418 (For primary document see N84-23293 13-81)
(AD-P002818) Avail: NTIS HC A24/MF A01 CSCL 05/1

In the coming years, American product quality will continue to be severely challenged in the world market place. We have lost much business and many jobs to foreign suppliers. Our nation's industry has suffered excessive loss of profits due to waste of materials and resources. Although foreign suppliers at one time held a substantial price advantage, this is no longer true in many instances. We are losing markets because of quality and reliability deficiencies. For the most part, American management has not fully grasped the impact of this quality challenge. They fail to recognize that effective quality control and assurance systems contribute significantly to profits, along with a product that conforms to specifications. Certain tasks are clearly defined for American

industry and the military establishment; high quality performance is essential. This paper is concluded with what is needed if we are to regain our position of leadership in the world marketplace.
Author (GRA)

N84-23364# Defense Logistics Agency, Alexandria, Va.
INCENTIVES FOR PRODUCT QUALITY NEED CONTRACT, COST, PRODUCTION AND FIELD CO-OPERATION Final Report c38
E. Theede *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 419-424 (For primary document see N84-23293 13-81)
(AD-P002819) Avail: NTIS HC A24/MF A01 CSCL 05/1

The quality of a deliverable item be it hardware or software, is dependent upon the controls in place and the adherence to those controls. Military procurement generally requires an inspection system (MIL-I-45208a) and a quality system (MIL-Q-9858a) to assure product quality. Monetary incentives must be available to the individual complying with the controls that produce the characteristics. Material inspection via statistical means only provides a clue as to how many defective units may be in the lot. Statistical sampling is obviously advantageous to a contractor since the government accepts the probability of receiving a defective product. All topics presented today are trying to help the government get the most for its money. The negative cost effects of material review boards, standard fixes (shop arrangements and field activities), statistical quality control, surplus parts procurement and contractor field service are usually figured in overhead and are not carefully examined and/or controlled. This paper will point out experiences in these areas and leave to your imagination how the heavy manhour involvement and costs associated with these areas could be minimized if quality incentives are provided at the point of manufacturing.
Author (GRA)

N84-23365# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
A QUALITY IMPROVEMENT STRATEGY FOR SYSTEMS ACQUISITION Final Report c38
G. J. Thielen *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 425-429 (For primary document see N84-23293 13-81)
(AD-P002820) Avail: NTIS HC A24/MF A01 CSCL 05/1

Affordability and readiness are among the most prominent concerns in the defense establishment today--to say nothing about the Congress and the media. Any number of techniques, procedures and controls have been established to improve management of systems acquisition and to minimize cost growth, the perennial nemesis of large, complex human endeavors. Cost/schedule control systems and reporting, for example, are now standard practice. No one technique, or combination of techniques, has yet been found to provide a satisfactory solution for today's acquisition managers. It is our purpose to portray quality in systems acquisition from this commercially-oriented perspective. An improvement strategy which is relevant to both readiness and affordability is outlined. It treats quality in its broadest, multifunctional sense. The bottom line is that if quality/productivity improvement is important to us in defense, then we must manage to get it. The strategy to be discussed is not a one-shot program or a quick fix. Rather, it is a basic shift in how we approach our work and is based on application of successful commercial practice to the system acquisition environment.
GRA

N84-23366# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
ENGINE PRODUCT PERFORMANCE AGREEMENTS AND THE FUTURE Final Report c38
J. Vertrees *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 430-434 (For primary document see N84-23293 13-81)
(AD-P002821) Avail: NTIS HC A24/MF A01 CSCL 05/1

Engine Product Performance Agreements may take many forms. One of these is warranty. The Model Engine Warranty developed by Air Force, iteratively, over a three year period is one of the many variations. It is to be tailored to fit the situation and was designed to help engine program managers formulate a warranty if one is part of their strategy. One possible outcome of considering warranty is that a warranty is not needed. This paper explores aspects of the Model Engine Warranty and its improvements over earlier warranties. Future forms of engine product performance agreements are mentioned. The concept of future commonality or standardization is discussed, with some of its perceived benefits.
Author (GRA)

N84-23367# Defense Systems Management School, Fort Belvoir, Va.
DEFENSE SYSTEMS ACQUISITION REVIEW PROCESS: A HISTORY AND EVALUATION Final Report
D. D. Acker *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 435-445 (For primary document see N84-23293 13-81)
(AD-P002822) Avail: NTIS HC A24/MF A01 CSCL 15/1

This paper presents the salient points from a 650-page report, and some of my comments regarding the effectiveness and efficiency of the defense systems acquisition review process. At the outset, the origin and evolution of the Defense Systems Acquisition Review Council (DSARC) and the Defense Resources Board (DRB) will be reviewed. Then observations and perceptions of the review process will be made based upon an analysis of several defense system programs. The fundamental question to be answered by the evaluation of the review process was whether experience has shown that DSARC reviews are still the most effective way to ensure a smooth transition of a defense system program from one program phase to the next phase. The experience data base used in answering this question was the result of: (1) fact-finding investigations of 16 programs, and (2) interviews with current and prior DoD officials having defense system management knowledge and experience. Conclusions and recommendations are offered based upon the results of the evaluation.
Author (GRA)

N84-23368# Logistics Management Inst., Washington, D. C.
A CONCEPT FOR MISSION-ORIENTED PLANNING FOR SYSTEM ACQUISITION AT THE DEFENSE COMMUNICATIONS AGENCY Final Report
F. L. Adler, C. B. Baird, and J. S. Domain *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 446-453 (For primary document see N84-23293 13-81)
(AD-P002823) Avail: NTIS HC A24/MF A01 CSCL 15/5

The Defense Communications Agency (DCA) is responsible for a broad range of system acquisition functions for Department of Defense (DoD) command, control, and communications (C3) programs as well as analytic and automatic data processing (ADP) support to the Joint Chiefs of Staff (JCS) and the Office of the Secretary of Defense (OSD). To better accomplish these functions DCA has begun a corporate-wide system integration initiative based on mission planning consistent with Department of Defense Directive (DoDD) 5000.1, Major System Acquisition. The initiative has three objectives: higher quality mission analysis, a better bridge from mission analysis into system acquisition, and more effective consideration of supportability of C3 systems and equipments. This paper describes DCA's planning initiative, its implementation approach, and the current status. The initiative, a mission-oriented planning concept, is currently under development and trial implementation within DCA.
Author (GRA)

N84-23369# Pittsburgh Univ., Pa.
PROJECT MANAGEMENT: EVOLUTION AND INFLUENCE Final Report
D. I. Cleland *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 454-459 (For primary document see N84-23293 13-81)
(AD-P002824) Avail: NTIS HC A24/MF A01 CSCL 05/1

This paper will briefly examine the evolution of the theory and practice of project (program) management as an integral part of the management discipline. This examination will hint at the origins

of project (program) management and how it has influenced the management of contemporary organizations. The authors will review some of the influences that project management has had on contemporary organizations. GRA

N84-23370# Defense Systems Management School, Fort Belvoir, Va.
PROGRAM MANAGER'S SUPPORT SYSTEM (PMSS): AN UPDATE Final Report
J. E. Cox, T. Ingalls, and H. J. Schutt *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 460-466 (For primary document see N84-23293 13-81)
(AD-P002825) Avail: NTIS HC A24/MF A01 CSCL 05/1

The Defense Systems Acquisition Process is a complicated process requiring the integration of many disciplines and functional areas. The Defense Program Manager (PM), in executing an assigned program within this environment, is faced with many non-routine and unstructured decisions. Although Management Information Systems (MIS) typically are available to the PM and provide information to aid in making these decisions, they predominately support only past and current project status, usually with an abundance, and many times perhaps, an over-abundance of data. A need exists, therefore, to support the PMs' decision-making process by looking at future courses of action and distilling the available data into meaningful alternatives. This need is being addressed at the Defense Systems Management College (DSMC) through a research project aimed at applying Decision Support System (DSS) technology to the Defense weapons systems program management environment. This paper describes the resultant Program Manager's Support System (PMSS) effort. It is an update to the PMSS presentation given at the 1982 Federal Acquisition Research Symposium. As such, this paper presents a brief background review, the functional requirements for such a system, the project's current status and future plans, and issues which must be addressed. GRA

N84-23371# Naval Electronic Systems Command, Washington, D. C.
MORTALITY AND SPAREPARTS: A CONCEPTUAL ANALYSIS Final Report c30
F. A. P. Frisch *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 467-480 (For primary document see N84-23293 13-81)
(AD-P002826) Avail: NTIS HC A24/MF A01 CSCL 15/5

The MORTALITY CONCEPT describes how a population deteriorates and what is needed to maintain a population. The populations considered are populations, or families, of spareparts needed to support military weapon systems. The mortality concept is explained and used to delineate the necessary resulting behavior of families of spareparts. The necessary behavior which follows is by necessity, from the selected MODE of acquisition (i.e., block-procurement) and from the selected QUALITY of the system. A generic model is sketched and sample calculations are provided to allow the reader to arrive at firm conclusions about the necessary behavior. Author (GRA)

N84-23372# Advanced Technology, Inc., Arlington, Va.
IMPROVING THE EFFECTIVENESS OF AWARD FEE CONTRACTS FOR PROGRAM MANAGEMENT SUPPORT SERVICES Final Report
A. C. Meiners, Jr. *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 481-483 (For primary document see N84-23293 13-81)
(AD-P002827) Avail: NTIS HC A24/MF A01 CSCL 15/5

This article reports on a method to improve the effectiveness of Cost Plus Award Fee contracts used for program management support services. The approach involves allowing employee participation in the receipt of award fee dollars thru a concept called Cost Plus Award Fee, Employee Participation, CPAF (EP). An example of an unsuccessful attempt to use CPAF (EP) is presented and a possible solution to problems associated with the use of EP on support service contracts is introduced. The recommended solution is centered around the use of a criteria oriented EP system, similar to criteria developed for Cost/Schedule Criteria System. A major element in the EP system presented is simplicity, in that any EP system must be easy for a contractor to administer. The article concludes with a structured recommendation that CPAF (EP) criteria be developed and tested. Author (GRA)

N84-23373# Office of the Under Secretary of Defense for Research and Engineering, Washington, D. C.
CONTRACT REQUIREMENTS: A KEY TO CONTROLLING DOD ACQUISITION COSTS Final Report c83
F. E. Doherty *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 485-489 (For primary document see N84-23293 13-81)
(AD-P002828) Avail: NTIS HC A24/MF A01 CSCL 15/5

This paper suggests that controlling contract requirements can hold the key to lowering DoD systems acquisition costs. It describes a proposed DoD initiative designed to help control imposition of non-cost-effective contract requirements in DoD contracts. Major recommendations from this report call for: (a) Specifying in request for proposals (RFPs) and contracts what is needed, not how to accomplish it; (b) requiring contractors to tailor during one phase for application to the next; (c) not requiring referenced documents to be contractural unless specifically identified as such; (d) ensuring that production specifications are not contractually applied to production; and (e) providing incentives to program managers to encourage accomplishment of the recommendations cited above. This paper concludes that the key problem to be solved is bridging the gap between current DoD policy and practice. GRA

N84-23374# Air Force Contract Management Div., Kirtland AFB, N. Mex.
MATERIAL HANDLING: A TARGET FOR PRODUCTIVITY IMPROVEMENT Final Report
R. T. Gibbons *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 490-494 (For primary document see N84-23293 13-81)
(AD-P002829) Avail: NTIS HC A24/MF A01 CSCL 05/1

On a national basis, productivity improvement is needed to prevent inflation. Without improvements in productivity to counteract increases in wages, cost and prices, such increases lead to inflationary conditions. Air Force Contract Management Division, in a constant effort to protect the taxpayer dollar has initiated many programs such as Project Cost Initiatives which increases the depth of contractor surveillance. One of these initiatives, Material Handling Productivity improvement, has a basis in industry and has caught the interest of the academic community. With the help of these two functions, AFCMD has mounted a campaign to not only increase the awareness of the contractor's material handling function, but also to apply productivity improvement principals for the benefit of both Department of Defense contractors and the tax paying public at large. GRA

N84-23375# University of Western Carolina, Cullowhee, N.C.
THE IMPACT OF FACTORY AUTOMATION AND ROBOTICS ON THE CONTRACTING AND ACQUISITION PROCESSES Final Report
M. D. Martin and R. D. Guyton *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 495-500 (For primary document see N84-23293 13-81)
(AD-P002830) Avail: NTIS HC A24/MF A01 CSCL 13/8

A report issued by the United States (U.S.) Comptroller General in 1976 noted that virtually every item produced by the U.S. industry is procured by the Federal Government. Products and services are procured by the Department of Defense (DoD) from over 25,000 industrial firms. The basic mechanism is through the contracting and acquisition processes. The key question raised by these circumstances is how will the increasing use of automation and robotics impact the contracting and acquisition processes in the 1980s and 1990s. A study was conducted to identify and classify the changes which will result from this trend to factory

automation. The items considered include: reclassification and structure of contract costs; contracting and acquisition planning; contract types and their use; cost visibility; labor and other direct costs; cost and price analysis; cost control; bidding and solicitation procedures; and, clause structure and selection. Author (GRA)

N84-23376# Army Procurement Research Office, Fort Lee, Va.
A SURVEY OF CONTRACTOR PRODUCTIVITY MEASUREMENT PRACTICES Final Report
M. G. Norton and W. V. Zabel *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 501-505 (For primary document see N84-23293 13-81)
(AD-P002831) Avail: NTIS HC A24/MF A01 CSCL 15/5

This paper is extracted from an interim APRO report describing the results of a survey of contractor productivity measurement practices. Respondents ranking organizational performance evaluation factors listed productivity fifth in importance behind profitability, effectiveness, quality, and efficiency. Problems encountered in measuring productivity were usually due to the complexities of quantifying and relating various input and output factors involved. Although no evidence was found from the survey that an integrated total factor productivity measurement system has been implemented, production cost and productivity information is available and currently being tracked with varying success by defense contractors. The most popular indices used are value added/employee and comparison of standard hours to actual hours. Author (GRA)

N84-23377# Defense Technical Information Center, Alexandria, Va.
STRENGTHENING SMALL BUSINESS PARTICIPATION IN DEPARTMENT OF DEFENSE EXTRAMURAL RESEARCH AND DEVELOPMENT Final Report
B. K. Dennis *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 507-511 (For primary document see N84-23293 13-81)
(AD-P002832) Avail: NTIS HC A24/MF A01 CSCL 05/1

This paper discusses steps taken by the Defense Technical Information Center (DTIC) to strengthen small business participation in DoD extramural R&D, indicates a need for explicit attention to information transfer requirements by R&D contract administrators and concludes with a suggestion to the DoD contract administration community. Many factors impede small business efforts to do R&D business with the federal government. These run the gamut from federal procurement policies, regulations, and procedures; beliefs, biases, and practices of federal R&D people and their management systems; and the formidable advantages of bigness in the federal marketplace. Information transfer issues exacerbate the impacts of all the above and further reduce small business capabilities to compete for and to perform federal agency-particularly DoD--R&D projects. The studies and testimony leading to the Small Business Innovation Development Act of 1982 indicated a need for change in federal agency approaches to R&D contracting. DTIC's approach has been to mitigate the impacts of information transfer barriers on small R&D firm efforts to do business with DoD. Author (GRA)

N84-23378# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
CONTRACTOR FRAUD: GOVERNMENT RESPONSE Final Report
J. O. Mahoy *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 512-516 (For primary document see N84-23293 13-81)
(AD-P002833) Avail: NTIS HC A24/MF A01 CSCL 15/5

Air Force Logistics support is adversely affected by the presence of fraud in Government contracts. Fraud occurs in the award of contracts, in the technical aspect of performance, and in the submission of false claims. Dishonest contractors, a small minority, must be found out and brought to justice. The response of the Government is channeled along several lines. Fraud is both a civil and a criminal matter. The Government may sue for financial recompense and may also invoke criminal penalties, and may debar bidders. The Contracting Officer and eventually the whole contracting team may be needed to detect fraud. The using activity, the Office of Special Investigation, the FBI and ultimately the Justice Department attorney and Federal Court are involved. Author (GRA)

N84-23379# Defense Logistics Agency, Alexandria, Va.
EMPLOYMENT CHANGES RESULTING FROM THE AWARD OF CONTRACTS IN LABOR SURPLUS AREAS Final Report c80
D. Robinson and D. Gill *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 517-525 (For primary document see N84-23293 13-81)
(AD-P002834) Avail: NTIS HC A24/MF A01 CSCL 15/5

Until 1981, the Department of Defense (DoD), as a result of amendments to their annual Appropriations Acts (known as the Maybank Amendment), had been prohibited from setting aside procurement contracts for award in labor surplus areas (LSAs) in order to relieve economic dislocations. In 1981 a coalition of Northeast and Midwest Congressmen succeeded in having the Defense Logistics Agency (DLA) test a modification to the Maybank Amendment and measure the local employment effects of increasing DLA contract awards in LSAs. In order to assure reasonably accurate predictions of employment impacts due to the DLA Maybank Test, the U.S. Army Corps of Engineers Construction Engineering Research Laboratory developed a computer-assisted regional economic impact model (called the DLA Employment Impact System) to assist DLA with their Congressional requirement. Author (GRA)

N84-23380# Rome Air Development Center, Griffiss AFB, N.Y.
AUTOMATING THE SOURCE SELECTION PROCESS Final Report
J. M. Barry and B. G. Pratt *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 527-528 (For primary document see N84-23293 13-81)
(AD-P002835) Avail: NTIS HC A24/MF A01 CSCL 15/5

A typical source selection involves considerable administration which contributes to the consumption of program and staff office resources. Normally these resources are expended at the sacrifice of regular program office project activities since a permanent, dedicated source selection team is not cost effective. The loss to a program can be measured in terms of schedule delays, contractual gaps, and loss management control over existing programs. Therefore, the efficient and speedy conduct of a source selection is essential to the Acquisition Process. This efficiency cannot be achieved by shortcutting the required processes of source selection evaluation, analysis, and ranking. However, automating the administrative aspects of a source selection can result in a 30-50% reduction in time and resources required to evaluate the proposal. This paper will focus how this administration can and has been reduced on an existing Air Force Program through the use of microcomputers. Author (GRA)

N84-23381# Notre Dame Univ., Ind.
INCREASING THE CONTRACTOR/SUBCONTRACTOR/ VENDOR BIDDING LISTS Final Report
J. G. Beverly, F. J. Bonello, J. Daschbach, and W. I. Davisson *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 529-532 (For primary document see N84-23293 13-81)
(Contract F33615-82-C-5121)
(AD-P002836) Avail: NTIS HC A24/MF A01 CSCL 15/5

Our intent in this paper is to demonstrate a method by which DoD (the Air Force) can increase the defense industrial base by increasing the list of companies that could bid on DoD vendor contracts as well as be available to bid on contracts from prime contractors. Our focus will be on small private business although the technique shown here could be applied to existing databases available for the establishments of SEC-registered corporations. GRA

N84-23382# Naval Sea Systems Command, Washington, D.C.
SELECTION OF MULTIPLE SOURCES IN WEAPON SYSTEMS ACQUISITION Final Report c89

J. W. Hargrove, Jr. *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 533-536 (For primary document see N84-23293 13-81)
(AD-P002837) Avail: NTIS HC A24/MF A01 CSCL 15/5

Discussion of source selection and evaluation techniques usually focus on selection of a single source to fulfill the government's weapon systems acquisition requirements. There are numerous instances when selection of multiple sources is an objective. The additional requirement to select multiple sources can greatly complicate the source selection process. Two major source selections conducted by the Naval Sea Systems Command for the Fast Logistic Ship SL-7 conversion (TAKRX) program and the Maritime Prepositioning Ship (TAKX) program illustrate techniques for selection of multiple sources in a highly complex situation. This paper discusses the significantly different procedures used in these two programs and identifies lessons learned. Selection of multiple sources requires considerable forethought to identify complicating factors and possible variations. Control of the number of variables is necessary to ensure a manageable process. Author (GRA)

N84-23383# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
THE SCORE TECHNIQUE: AN ANALYTICAL APPROACH FOR ASSESSING THE RESULTS OF MANUFACTURING REVIEWS Final Report
R. S. Lieber and M. C. Edelblute *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 537-546 (For primary document see N84-23293 13-81)
(AD-P002838) Avail: NTIS HC A24/MF A01 CSCL 15/5

Since the early 1970's, the techniques for conducting manufacturing assessments have improved as the lessons-learned from each new team were passed on the next. However, one area of the manufacturing assessment process, the scoring, has remained relatively unchanged over the years. This paper presents a fresh approach to the scoring process. The process outlined in this paper was first developed and used on the Next Generation Trainer Program. Since then, it has been applied successfully to other Aeronautical Systems Division manufacturing reviews both in Europe and the United States. The methods discussed here can be applied to other scoring scenarios such as source selection, Cost/Schedule Criteria System (C/SCS) reviews, and related review. The technique is generally applicable to any problem whose solution can be improved by adding objectivity and traceability to an otherwise subjective scoring process. GRA

N84-23384# Air Force Systems Command, Bolling AFB, Washington, D.C.
AIR FORCE SYSTEMS COMMAND RESEARCH PLANNING GUIDE (RESEARCH OBJECTIVES)
1 Feb. 1984 209 p
(AD-A138851; AFSC-TR-84-02; AFSC-TR-82-01) Avail: NTIS HC A10/MF A01 CSCL 05/1

The purpose of the Planning Guide is to direct the attention of the scientific community to the technology interests of the Air Force, to provide a prospectus of research objectives to which the scientific community can respond, and to document the relevancy of fundamental to the Air Force mission. The research objectives described here represent the combined counsel of technical directors and program managers at the Air Force research and development laboratories. These objectives enunciate scientific opportunities which, when exploited, will provide fundamental knowledge required to develop future Air Force systems, prevent technological surprises, and provide alternatives in solving technological problems which mitigate the quantitative superiority of Air Force systems. The objectives are grouped into eight technical areas: life sciences, materials, geophysics, aerospace vehicles, propulsion and power, weaponry, electronics, and computational sciences. These areas relate directly to Air Force mission areas and involve such scientific disciplines as physics, chemistry, biology, psychology, mathematics, and engineering. GRA

N84-23385# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
PUBLICATION IN PROFESSIONAL JOURNALS IN SCIENCE AND ENGINEERING: A SURVEY OF EDITORIAL PROCEDURES AND OPINION Final Report
R. M. Davis Feb. 1984 66 p
(AD-A138913; AD-E950486; AU-AFIT-LS-1-84) Avail: NTIS HC A04/MF A01 CSCL 05/1

With the rapidly increasing pace of advancement in scientific and technical fields, it has become more and more critical that professionals in those fields maintain currency. They must keep abreast of significant advances as they occur, inform others of their own contributions to the field concerned, and exchange ideas and experience with their colleagues. The professional societies, of course, are the primary forum through which this is done, and their meetings, symposia, and publications are the principal media. The survey reported here was undertaken to develop information about publication in a limited number of journals in high technological areas published by professional societies. The editors themselves are the primary authorities on these matters. They know what they do, and how and why they do it the constraints on them, the problems that they encounter, and the basis for decisions that they make. So it seemed reasonable to solicit their comments on the process of publication within the journals they edit and any advice that they might have for potential contributors. These should be of particular interest to all who might wish to contribute to these or similar journals. GRA

N84-23386# Rolls-Royce Ltd., Derby (England).
CORPORATE DP PLANNING: NEW APPROACHES AND NEW CONCERNS
Julien H. Russel 12 Jul. 1983 11 p
(PNR-90180; Reprint-893) Avail: NTIS HC A02/MF A01

Management of data processing systems development in the aircraft industry is discussed. Software development strategies and user requirements are considered. Author (ESA)

N84-23387# Joint Publications Research Service, Arlington, Va.
USSR REPORT: SCIENCE AND TECHNOLOGY POLICY
23 Feb. 1984 72 p refs Transl. into ENGLISH from various Russian articles
(JPRS-UST-84-004) Avail: NTIS HC A04

The economic, production, management, and research policies that pertain to the development of science and technology are examined. Progress is evaluated in economic aspects of research and development, computerized design and simulation, management and production planning, and patent policies. Plans for the improvement of project management and technology development are presented. For individual titles, see N84-23388 through N84-23390.

N84-23388# Joint Publications Research Service, Arlington, Va.
INCENTIVES FOR NEW PRODUCTION DISCUSSED
A. S. Kolesnikov and V. V. Starovit *In its* USSR Rept.: Sci. and Technol. Policy (JPRS-UST-84-004) 23 Feb. 1984 p 1-14 Transl. into ENGLISH from Izv. Akad. Nauk SSSR: Ser. Ekon. (USSR), no. 4, Apr. 1983 p 37-46 (For primary document see N84-23387 13-81)
Copyright. Avail: NTIS HC A04

Patent policy and the incentives used to develop new technologies are examined. Patents are divided into three categories based on importance of the invention and government control of the license for foreign use. Possible incentive techniques and general suggestions for the development of a monetary bonus system for inventors is presented. M.A.C.

N84-23389# Joint Publications Research Service, Arlington, Va.
USE OF ECONOMIC MECHANISMS IN MANAGING SCIENTIFIC AND TECHNICAL PROGRESS
P. Pogudin and Ye. Osatyuk *In its* USSR Rept.: Sci. and Technol. Policy (JPRS-UST-84-004) 23 Feb. 1984 p 15-24 Transl. into ENGLISH from Planovoye Khozyaystvo (USSR), no. 11, Nov. 1983 p 72-78 (For primary document see N84-23387 13-81)

Copyright. Avail: NTIS HC A04

The use of economic incentives as a means of stimulating scientific and technical progress is discussed. Research and development in the chemical industry is used as an example for analysis and economic modeling. The economic effect of these incentives on scientific organizations and the resulting research is examined with added suggestions for future incentive funds included. M.A.C.

N84-23390# Joint Publications Research Service, Arlington, Va.
COMPUTER DEVELOPMENTS AT INSTITUTE OF AUTOMATION AND ELECTROMETRY DESCRIBED c60
B. Konovalov *In its* USSR Rept.: Sci. and Technol. Policy (JPRS-UST-84-004) 23 Feb. 1984 p 45-49 Transl. into ENGLISH from Izv. (USSR), 17 Sep. 1983 p 2 (For primary document see N84-23387 13-81)
Copyright. Avail: NTIS HC A04

Developments in the use of computers in automation technology are examined. The research in computer aided design, manufacturing, and computerized test simulations is discussed. Methods of data storage and suggestions for the integration of computer systems to optimize labor management and increase production are included. M.A.C.

N84-23391# Joint Publications Research Service, Arlington, Va.
USSR REPORT: SCIENCE AND TECHNOLOGY POLICY
28 Feb. 1984 92 p refs Transl. into ENGLISH from various Russian articles
(JPRS-UST-84-007) Avail: NTIS HC A05

Performance indicators for technological institutes and research in human factors engineering are examined along with reports on various scientific and technical organization conferences. Discussed topics included computer programs, resource and personnel management, cost analysis, and project planning. The conferences also describe the scientific and technological policies used to accomplish the research tasks. For individual titles, see N84-23392 through N84-23393.

N84-23392# Joint Publications Research Service, Arlington, Va.
TECHNICAL AND ECONOMIC INDICATORS FOR INDUSTRIAL TECHNOLOGICAL INSTITUTES
Yu. Berliner *In its* USSR Rept.: Sci. and Technol. Policy (JPRS-UST-84-0070 28 Feb. 1984 p 11-19 Transl. into ENGLISH from Planovoye Khozyatstvo (USSR), no. 11, Nov. 1983 p 78-82 (For primary document see N84-23391 13-81)
Copyright. Avail: NTIS HC A05

The development of a coherent policy for the evaluation of technical and economic indicators for scientific research is investigated. The effectiveness of technological and scientific institutes based on economic impact is determined with emphasis on production costs, labor management, and resource allocation. The reorganization necessary to implement the proposed evaluation policy is included. M.A.C.

N84-23393# Joint Publications Research Service, Arlington, Va.
RESEARCH IN MAN-MACHINE INTERACTION DISCUSSED c54
D. Balagezyan *In its* USSR Rept.: Sci. and Technol. Policy (JPRS-UST-84-007) 28 Feb. 1984 p 64-66 Transl. into ENGLISH from Kommunist (USSR), 20 Sep. 1983 p 2 (For primary document see N84-23391 13-81)
Copyright. Avail: NTIS HC A05

Research in human factors engineering is examined. Emphasis is placed on labor management and productivity and how they relate to various man/machine systems. An overview of the current research is included. M.A.C.

N84-23394# Joint Publications Research Service, Arlington, Va.
USSR REPORT: SCIENCE AND TECHNOLOGY POLICY
23 Feb. 1984 94 p refs Transl. into ENGLISH from various Russian articles
(JPRS-UST-84-005) Avail: NTIS HC A05

This serial report contains news items, abstracts and articles of scientific reports on aspects of science and technology including prerequisites for scientific technical progress, science management, technology transfer, production automation, and the role of scientific progress in productivity. For individual titles, see N84-23395 through N84-23397.

N84-23395# Joint Publications Research Service, Arlington, Va.
PREREQUISITES FOR SCIENTIFIC-TECHNICAL PROGRESS ENUMERATED
A. Ye. Varshavskiy *In its* USSR Rept.: Sci. and Technol. Policy (JPRS-UST-84-005) 23 Feb. 1984 p 1-13 refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR: Ser. Ekon. (USSR), no. 6, Nov.-Dec. 1983 p 36-46 (For primary document see N84-23394 13-81)
Copyright. Avail: NTIS HC A05

The most important trends in scientific and technical development are used as the basis for an examination of problems in the assessment of the scientific and technical potential of national economic sectors and methods of accelerating its growth rate. Author

N84-23396# Joint Publications Research Service, Arlington, Va.
PROBLEMS OF PROMPT ADOPTION OF NEW TECHNOLOGY DISCUSSED
A. Ivakhnov *In its* USSR Rept.: Sci. and Technol. Policy (JPRS-UST-84-005) 23 Feb. 1984 p 28-33 Transl. into ENGLISH from Izv. (USSR), 6 Dec. 1983 p 2 (For primary document see N84-23394 13-81)
Copyright. Avail: NTIS HC A05

The way of solving many economic problems facing the country lies in activation of scientific research, strengthening the tie between science and production and speeding up introduction of the achievements of science and technology into the national economy. Scientists, ministers and personnel of planning organs know this. But time passes and sometimes a tremendous distance exists to the time of introduction of new developments. Why does that happen? Usually, the ministries in question have a ready answer: either the plan was not reinforced with resources, or the construction people let it down, or subcontractors failed to deliver materials or equipment on time. At the same time, the State Plan for Economic and Social Development of the USSR whose constituent parts consist of scientific-technical programs is the same for all and its fulfillment is the law of our economy. Deputies of the USSR Supreme Soviet--members of the preparatory commission--discussed this quite specifically. Such organs form permanent commissions of the chambers for analysis of materials presented by ministries and departments. Author

N84-23397# Joint Publications Research Service, Arlington, Va.
LANDMARKS OF PROGRESS
A. Alexandrov *In its* USSR Rept.: Sci. and Technol. Policy (JPRS-UST-84-005) 23 Feb. 1984 p 48-51 Transl. into ENGLISH from APN Daily Rev. (USSR), 9 Nov. 1983 p 1-5 (For primary document see N84-23394 13-81)
Copyright. Avail: NTIS HC A05

The annual awarding by the CPSU Central Committee and the Council of Ministers of the USSR of State Prizes of the USSR for outstanding scientific and technical accomplishments and for textbooks of superior quality symbolizes the extraordinary importance attached by our party and Soviet Government to the scientific and technical progress of the country. The works nominated for state prizes from 1 year to another are growing. Most of them deserve a very high appraisal. But the requirements to them are growing, too. This was characteristic of all stages, no matter whether these works were nominated at institutes or industrial works, or were extensively discussed in sections of our committee, in the press and in research institutions, or at the plenary session of our committee. Of the 180 works submitted this year, 80 were allowed to enter the contest after careful examination. The CPSU Central Committee and the Council of Ministers of the USSR have awarded state prizes of the USSR to 44 works and four textbooks at the committee's recommendations. Author

N84-22843# Scicon Consultancy International Ltd., London (England).
COMMAND DECISION MAKERS AND THEIR MODES OF INTERACTION
P. D. Morgan *In* MIT Proc. of the 6th MIT/ONR Workshop on C3 (Command, Control, and Commun.) Systems Dec. 1983 p 61-66 (For primary document see N84-22835 13-32)
(AD-P002882) Avail: NTIS HC A14/MF A01 CSCL 14/2

N84-22845# Connecticut Univ., Storrs. Dept. of Electrical Engineering and Computer Science.
HUMAN DECISIONMAKING IN DYNAMIC ENVIRONMENTS WITH INCREASING INFORMATION PROCESSING DEMANDS
D. Serfaty, E. P. Soulsby, and D. L. Kleiman *In* MIT Proc. of the 6th MIT/ONR Workshop on C3 (Command, Control, and Commun.) Systems Dec. 1983 p 76-82 (For primary document see N84-22835 13-32)
(AD-P002884) Avail: NTIS HC A14/MF A01 CSCL 12/1

N84-22846# ALPHATECH, Inc., Burlington, Mass.
INDIVIDUAL DIFFERENCES IN MILITARY DECISIONMAKING: THE CLASSIFICATION PERFORMANCE OF ACTIVE SONAR OPERATORS
J. G. Wohl *In* MIT Proc. of the 6th MIT/ONR Workshop on C3 (Command, Control, and Commun.) Systems Dec. 1983 p 83-86 (For primary document see N84-22835 13-32)
(DA Proj. M01-00-PN)
(AD-P002885) Avail: NTIS HC A14/MF A01 CSCL 05/10

N84-22847# Navy Personnel Research and Development Center, San Diego, Calif.
DECISION AND DISPLAY ANALYSIS IN A SIMPLE SURVEILLANCE PROBLEM
F. L. Greitzer and R. L. Hershman *In* MIT Proc. of the 6th MIT/ONR Workshop on C3 (Command, Control, and Commun.) Systems Dec. 1983 p 91-95 (For primary document see N84-22835 13-32)
(AD-P002886) Avail: NTIS HC A14/MF A01 CSCL 05/10

N84-22850# Decision Science Consortium, Inc., Falls Church, Va.
TACTICAL DECISION AIDS WHICH QUANTIFY JUDGMENT
R. V. Brown and M. S. Cohen *In* MIT Proc. of the 6th MIT/ONR Workshop on C3 (Command, Control, and Commun.) Systems Dec. 1983 p 106-108 (For primary document see N84-22835 13-32)
(Contract N00014-80-C-0046)
(AD-P002889) Avail: NTIS HC A14/MF A01 CSCL 05/10

N84-22851# Virginia Univ., Charlottesville. Dept. of Engineering Science and Systems.
A KNOWLEDGE BASED INTERACTIVE PROCEDURE FOR PLANNING AND DECISION SUPPORT UNDER UNCERTAINTY AND PARAMETER IMPRECISION
A. P. Sage and C. C. White, III *In* MIT Proc. of the 6th MIT/ONR Workshop on C3 (Command, Control, and Commun.) Systems Dec. 1983 p 109-116 (For primary document see N84-22835 13-32)
(Contract N00014-80-C-0542)
(AD-P002890) Avail: NTIS HC A14/MF A01 CSCL 05/10

N84-22852# Virginia Univ., Charlottesville.
AN EVALUATION OF ARIADNE (ALTERNATIVE RANKING INTERACTIVE AID BASED ON DOMINANCE STRUCTURE INFORMATION ELICITATION)
C. C. White, III , A. P. Sage, S. Dozono, and W. T. Scherer *In* MIT Proc. of the 6th MIT/ONR Workshop on C3 (Command, Control, and Commun.) Systems Dec. 1983 p 117-121 (For primary document see N84-22835 13-32)
(Contract N00014-80-C-0542)
(AD-P002891) Avail: NTIS HC A14/MF A01 CSCL 05/10

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software.*

N84-23398* National Aeronautics and Space Administration, Washington, D. C.
NASA THESAURUS SUPPLEMENT. PART 1: HIERARCHICAL LISTING
Jan. 1984 23 p
(NASA-SP-7051(Suppl-1); NAS 1.21:7051(Suppl-1)) Avail: NTIS HC A02 CSCL 05B

This cumulative, semiannual update to the NASA Thesaurus contains complete hierarchies for all terms added since the 1982 edition, an access vocabulary, and a list of deleted terms. A.R.H.

N84-23399 Rochester Univ., N. Y.
COMPUTER AND DATABASE LOCATION IN DESIGNING DISTRIBUTED COMPUTER SYSTEMS Ph.D. Thesis
Hasan Pirkul 1983 214 p
Avail: Univ. Microfilms Order No. DA8403160

The issues of locating computers and allocating data bases among computers are discussed. In many cases, organizational factors and management preferences result in predetermination of computer sites as well as the type of computers to be placed in each site. If this is the case, then the problem becomes one of assigning data bases to a set of computers without violating various capacity constraints of each computer. The second problem pertains to the design of homogeneous computer systems. Here, the designer determines not only the type of computer to be used but also the number and location of computers and the allocation of data bases to these computers. The third problem addresses issues faced in designing heterogeneous computer systems. The problems are formulated as linear integer programming models. Solution procedures are developed for each of these problems. These models are treated as design tools and are used in investigating the implications of various design decisions.
Dissert. Abstr.

N84-23400 Northwestern Univ., Evanston, Ill.
ORDER-PRESERVING DYNAMIC HASHING SCHEMES FOR ASSOCIATIVE SEARCHING IN DATA BASE SYSTEMS Ph.D. Thesis
Mohamed Ouksel 1983 212 p
Avail: Univ. Microfilms Order No. DA8400718

Multidimensional storage mappings suitable for dynamic data bases are presented. The first scheme is a natural extension of Litwin's Linear Hashing. The storage space is allowed to gracefully expand or contract as desired, the storage utilization can be very high and is programmer controllable, no directory is needed to answer exact match and partial match queries, and retrieval and update operations are simple and efficient. Simulation results confirm the high performance. The basic method is extended to handle range queries by using axial directories which preserve the order among the records on each of the d attributes and whose total space requirement is very small. The basic scheme which is based on a predetermined cyclic order among the attributes (or the axes) is further improved by allowing a more flexible order. In a second step, a generalization is obtained by totally relaxing the cyclic order constraint. As a result, further optimizations are possible. Dissert. Abstr.

N84-23401*# Arinc Research Corp., Annapolis, Md.
ASSESSMENT OF THE NASA FLIGHT ASSURANCE REVIEW PROGRAM
J. Holmes and G. Pruitt Aug. 1983 172 p refs
(Contract NASw-3787)
(NASA-CR-173418; NAS 1.26:173418;
ARINC-Res-Publ-3104-01-TR-3100) Avail: NTIS

HC A08/MF A01 CSCL 05B

The NASA flight assurance review program to develop minimum standard guidelines for flight assurance reviews was assessed. Documents from NASA centers and NASA headquarters to determine current design review practices and procedures were evaluated. Six reviews were identified for the recommended minimum. The practices and procedures used at the different centers to incorporate the most effective ones into the minimum standard review guidelines were analyzed and guidelines for procedures, personnel and responsibilies, review items/data checklist, and feedback and closeout were defined. The six recommended reviews and the minimum standards guidelines developed for flight assurance reviews are presented. Observations and conclusions for further improving the NASA review and quality assurance process are outlined. E.A.K.

N84-23402# Rome Air Development Center, Griffiss AFB, N.Y.
BEYOND THE DATA BASE: TECHNOLOGY FOR INFORMATION RESOURCE MANAGEMENT
P. M. Langendorf Dec. 1983 43 p
(AF Proj. 4594)
(AD-A138840; RADC-TR-83-312) Avail: NTIS HC A03/MF A01 CSCL 09/2

This report is about data in our society. It first discusses values, how people feel about using data. It then discusses how man has used the technology that is available as tools in handling data, and how data handling has changed as technology changes. Information resource management is now changing very rapidly as new technology becomes available. The report argues that the complex programs we call data base management systems (DBMS) are an artifact of monolithic computers with hierarchies of secondary storage managed by complex general purpose operating systems. The next step will take the DBMS apart, distributing the data management functions to provide the same capabilities with less constraints. The report concludes with a discussion of theory regarding computer based data management. It covers the intellectual ferment following the introduction of random access secondary storage, the development of CODASYL, and the relational model. It briefly discusses the familiar arguments regarding the need to separate logical data definition from the physical location of data, stressing different representational requirements. The report concludes with the author's view of what is needed to form an adequate foundation for information resource management system development. Author (GRA)

N84-23403# Army Natick Research and Development Command, Mass.
BIBLIOGRAPHY OF TECHNICAL PUBLICATIONS AND PAPERS, OCTOBER 1982 - SEPTEMBER 1983 Annual Report, for FY 1983
Nov. 1983 27 p
(AD-A138907; NATICK/TR-84/001) Avail: NTIS HC A03/MF A01 CSCL 05/2

This report contains a bibliographic listing of technical publications and papers presented by personnel of the US Army Natick Research & Development Center and its contractors for the period October 1982 through September 1983. Author (GRA)

N84-23404# Army Construction Engineering Research Lab., Champaign, Ill.
A STUDY OF MX ENVIRONMENTAL MANAGEMENT INFORMATION SYSTEM (MXEMIS) NEEDS Final Report
R. Webster, R. Mitchell, and V. Young Dec. 1983 31 p
(AD-A139025; AD-E401136; CERL-TR-N-169) Avail: NTIS HC A03/MF A01 CSCL 05/2

This report identifies and provides information about various environmental management information systems (EMIS) and subsystems which may be used to analyze the environmental impacts of MX missile deployment. Three categories of EMIS were investigated: The Environmental Technical Information System and its related systems; other environmental management systems; and geographic information systems. Information in this report can also serve as a reference guide to the EMIS subsystems available. Author (GRA)

N84-23405 Indiana Univ., Bloomington.
TOWARD A THEORY OF LIBRARY AND INFORMATION SCIENCE Ph.D. Thesis
Alvin Marvin Schrader 1983 1016 p
Avail: Univ. Microfilms Order No. DA8401534

An adequate definition of the domain of library and information science is proposed. Logical and conceptual analysis is applied to the task of defining the domain of library and information science. Extent definition are examined from the literature and their diverse usage of terms is set forth. Basic concepts are identified and for each basic concept the synonymous terms are brought together. In this way a typology of generic definitions is developed. The logical adequacy of each generic definition is considered. The SIGGS methatheory, an extension of general system theory is presented as a way of enhancing domain conceptualization. In this enhancement, library and information science is taken to be a system of human social practice in which one person facilitates access to selected cultural objects on behalf of another person who is seeking access to them. The practice so characterized is the symbolic culture accessing system. Dissert. Abstr.

N84-23406 Maryland Univ., College Park.
STRATEGIES AND MECHANISMS FOR THE DIFFUSION OF SCIENTIFIC AND TECHNICAL INFORMATION: A COMPARATIVE STUDY Ph.D. Thesis
Zenete Maria Peixoto da Silva Franca 1983 174 p
Avail: Univ. Microfilms Order No. DA8402558

Existing strategies and mechanisms for the diffusion of scientific and technical information through an analysis of selected doctoral dissertations are analyzed. The major results of the study were as follows: (1) On the basis of Lewin's three-phase paradigm for planned change, seven types of information strategy were identified: Delivery, Information Network, Adoption-Diffusion, Decision-making, Direct Foreign Investment, Research, Development and Diffusion, and Social Behavioral; (2) A wide variety of mechanisms were noted; (3) Chi-square testing showed that personal mechanisms were significantly more effective than other types of mechanism; (4) A model was constructed which reflected the variation in communication sources and channels as well as the role of social cultural pressures and decision-making functions at all three levels of information dissemination. This model is applied to the communication process between developed nations to end-users in less developed countries. Dissert. Abstr.

N84-22839# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
INFORMATION PROCESSING AND DECISIONMAKING ORGANIZATIONS: A MATHEMATICAL DESCRIPTION
A. H. Levis *In its* Proc. of the 6th MIT/ONR Workshop on C3 (Command, Control, and Commun.) Systems Dec. 1983 p 30-38 (For primary document see N84-22835 13-32)
(Contracts N00014-83-K-0185; MDA903-83-C-0196)
(AD-P002878) Avail: NTIS HC A14/MF A01 CSCL 12/1

N84-22848# Illinois Univ., Urbana.
THE EFFECTS OF A SPATIAL INFORMATION FORMAT ON DECISION MAKING PERFORMANCE IN A C3 (COMMAND, CONTROL, AND COMMUNICATIONS) PROBABILISTIC INFORMATION INTEGRATION TASK
B. Scott and C. D. Wickens *In* MIT Proc. of the 6th MIT/ONR Workshop on C3 (Command, Control, and Commun.) Systems Dec. 1983 p 96-99 (For primary document see N84-22835 13-32)
(Contract N00014-79-C-0658)
(AD-P002887) Avail: NTIS HC A14/MF A01 CSCL 09/4

N84-22861# Massachusetts Inst. of Tech., Cambridge.
THE DESIGN OF INFORMATION STRUCTURES: BASIC ALLOCATION STRATEGIES FOR ORGANIZATIONS
D. A. Stabile and A. H. Levis *In its* Proc. of the 6th MIT/ONR

Workshop on C3 (Command, Control, and Commun.) Systems Dec. 1983 p 219-225 Prepared in cooperation with ICF, Inc., Washington, D.C. (For primary document see N84-22835 13-32)
(Contracts N00014-77-C-0532; N00014-83-K-0185; Grant AF-AFOSR-0229-80)
(AD-P002909) Avail: NTIS HC A14/MF A01 CSCL 09/4

N84-22864# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
OPTIMAL FILE ALLOCATION PROBLEMS FOR DISTRIBUTED DATA BASES IN UNRELIABLE COMPUTER NETWORKS, 2
M. H. Ma and M. Athans *In its* Proc. of the 6th MIT/ONR Workshop on C3 (Command, Control, and Commun.) Systems Dec. 1983 p 255-267 (For primary document see N84-22835 13-32)
(AD-P002913) Avail: NTIS HC A14/MF A01 CSCL 09/2

N84-23298# Air Force Systems Command, Wright-Patterson AFB, Ohio.
THE ACQUISITION MANAGEMENT INFORMATION SYSTEM: FRIEND OR FOE? Final Report
C. R. Cook *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 23-27 (For primary document see N84-23293 13-81)
(AD-P002751) Avail: NTIS HC A24/MF A01 CSCL 15/5

N84-23299# Defense Logistics Agency, Alexandria, Va.
CONSOLIDATION OF DOD BIDDER'S MAILING LIST APPLICATION Final Report
E. Parsons *In* AF Business Res. Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 28-31 (For primary document see N84-23293 13-81)
(AD-P002752) Avail: NTIS HC A24/MF A01 CSCL 15/5

N84-23353# Army DARCOM Materiel Readiness Support Activity, Lexington, Ky.
CENTRAL DEMAND DATA BASE (CDDB) END ITEM CODE (EIC) Final Report
G. Campbell *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 341-344 (For primary document see N84-23293 13-81)
(AD-P002807) Avail: NTIS HC A24/MF A01 CSCL 15/5

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N84-22844# Massachusetts Inst. of Tech., Cambridge.
INFORMATION THEORETIC MODELS OF MEMORY IN HUMAN DECISIONMAKING MODELS
S. A. Hall and A. H. Levis *In its* Proc. of the 6th MIT/ONR Workshop on C3 (Command, Control, and Commun.) Systems Dec. 1983 p 67-75 Prepared in cooperation with RCA Astro-Electronics Div., Princeton, N.J. (For primary document see N84-22835 13-32)
(Grant AF-AFOSR-0029-80)
(AD-P002683) Avail: NTIS HC A14/MF A01 CSCL 12/1

N84-23300# Cockerham (John M.) and Associates, Inc., Hopewell, Va.
COST RISK TRADE-OFFS IN TIMING THE PRODUCTION DECISION Final Report
J. M. Cockerham *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 33-38 (For primary document see N84-23293 13-81)
(AD-P002753) Avail: NTIS HC A24/MF A01 CSCL 15/5

N84-23317# Logistics Management Inst., Washington, D. C.
ANALYSIS OF INCENTIVES FOR PRODUCTIVITY-ENHANCING INVESTMENT Final Report
G. Gottschalk, M. G. Myers, and M. J. Konvalinka *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 130-134 (For primary document see N84-23293 13-81)
(AD-P002770) Avail: NTIS HC A24/MF A01 CSCL 15/5

N84-23339# Management Consulting and Research, Inc., Falls Church, Va.
THE PROBLEM OF COST GROWTH Final Report
G. R. McNichols and B. J. McKinney *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 251-254 (For primary document see N84-23293 13-81)
(AD-P002792) Avail: NTIS HC A24/MF A01 CSCL 15/5

N84-23340# Advanced Technology, Inc., Arlington, Va.
ECONOMIC PRODUCTION RATE STUDY Final Report
E. J. Downing, Jr., G. E. Roesler, and W. M. McGovern *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 256-261 (For primary document see N84-23293 13-81)
(AD-P002793) Avail: NTIS HC A24/MF A01 CSCL 15/5

N84-23341# Ohio State Univ., Columbus.
EXPERT SYSTEMS FOR PRICE ANALYSIS: A FEASIBILITY STUDY Final Report
J. F. Dillard, K. Ramarkrishna, and B. Chandrasekaran *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 270-274 (For primary document see N84-23293 13-81)
(Contract F33615-82-C-5114)
(AD-P002795) Avail: NTIS HC A24/MF A01 CSCL 15/5

N84-23342# Naval Postgraduate School, Monterey, Calif.
CONTRACTOR 'HUNGRINESS' AND THE RELATIVE PROFITABILITY OF DOD BUSINESS Final Report
W. R. Greer, Jr. and S. S. Liao *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 275-279 (For primary document see N84-23293 13-81)
(AD-P002796) Avail: NTIS HC A24/MF A01 CSCL 15/5

N84-23343# Management Consulting and Research, Inc., Falls Church, Va.
INDEPENDENT COST ESTIMATES: A CASE STUDY JOINT VERTICAL LIFT AIRCRAFT (JVX) PROGRAM Final Report
G. R. McNichols and G. L. Sorrell *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 280-283 (For primary document see N84-23293 13-81)
(AD-P002797) Avail: NTIS HC A24/MF A01 CSCL 15/5

N84-23344# Ohio State Univ., Columbus.
AN INTELLIGENT MANUAL FOR PRICE ANALYSIS Final Report
K. Ramakrishna, J. F. Dillard, T. G. Harrison, and B. Chandrasekaran *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 284-290 (For primary document see N84-23293 13-81)
(Contract F33615-82-C-5114)
(AD-P002798) Avail: NTIS HC A24/MF A01 CSCL 15/5

N84-23345# Delaware Univ., Newark.
ON 'BEFORE' AND 'AFTER' COST COMPARISONS Final Report
R. M. Stark *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 291-293 (For primary document see N84-23293 13-81)
(AD-P002799) Avail: NTIS HC A24/MF A01 CSCL 15/5

N84-23346# Science Applications, Inc., McLean, Va.
COST REALISM: ASSURING MORE REALISTIC CONTRACTOR COST PROPOSALS Final Report
D. L. Trapp *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 294-300 (For primary document see N84-23293 13-81)
(AD-P002800) Avail: NTIS HC A24/MF A01 CSCL 15/5

N84-23373# Office of the Under Secretary of Defense for Research and Engineering, Washington, D. C.
CONTRACT REQUIREMENTS: A KEY TO CONTROLLING DOD ACQUISITION COSTS Final Report
F. E. Doherty *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 485-489 (For primary document see N84-23293 13-81)
(AD-P002828) Avail: NTIS HC A24/MF A01 CSCL 15/5

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N84-23324# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
NAILING DOWN THE LIABILITY ISSUE ONCE AND FOR ALL Final Report
W. C. Pursch *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 175-183 (For primary document see N84-23293 13-81)
(AD-P002777) Avail: NTIS HC A24/MF A01 CSCL 15/5

N84-23325# Defense Contract Administration Services, Boston, Mass.
DOES THE PROMPT PAYMENT ACT INSURE TIMELY CONTRACT PAYMENT? Final Report
M. E. Wilson *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 179-180 (For primary document see N84-23293 13-81)
(AD-P002778) Avail: NTIS HC A24/MF A01 CSCL 15/5

N84-23352# Army DARCOM Materiel Readiness Support Activity, Lexington, Ky.
THE NEW MIL-STDS (MILITARY STANDARD) 1388 Final Report
J. E. Peer and D. L. McChrystal *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 334-339 (For primary document see N84-23293 13-81)
(AD-P002806) Avail: NTIS HC A24/MF A01 CSCL 15/5

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N84-23319# Iowa State Univ. of Science and Technology, Ames. Center for Industrial Research and Service.
THE GOVERNMENT RELATIONSHIP TO INDUSTRY IN TECHNOLOGY TRANSFER AND DEVELOPMENT Final Report
D. H. Swanson *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 143-148 (For primary document see N84-23293 13-81)
(AD-P002772) Avail: NTIS HC A24/MF A01 CSCL 05/1

88 SPACE SCIENCES (GENERAL)

N84-23407 Max-Planck-Institut fuer Physik und Astrophysik, Munich (West Germany). Inst. for Extraterrestrial Physics.
ACTIVITIES REPORT OF THE INSTITUTE FOR EXTRATERRESTRIAL PHYSICS Annual Report, 1982
Jan. 1984 115 p refs In GERMAN Original contains color illustrations
Avail: Issuing Activity

Research into the ionosphere and auroras, magnetosphere and solar winds, particle beams in the magnetosphere and in interplanetary spaces is summarized. Tracking systems in infrared and X-ray astronomy and laboratory research are reported. Research into flare and burst incidents, low and high energy in gamma ray astronomy are treated. Carbon monoxide, NO and MgCa molecules which are studied by fluorescent and excitation spectroscopy are outlined. E.A.K.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N84-23408 Indiana Univ., Bloomington.
TIME-RESOLVED SPECTROPHOTOMETRY OF THE NOVA-LIKE CATACLYSMIC VARIABLES RW TRIANGULUM AND UX URSA MAJORIS Ph.D. Thesis
Eric Matthew Schlegel 1983 158 p
Avail: Univ. Microfilms Order No. DA8401587

The nova-like cataclysmic systems RW Tri and UX UMa have been studied by time-resolved spectrophotometry. The spectra have provided continuum and emission line light curves, line profiles, and radial velocities as a function of orbital phase. RW Tri shows a deep continuum eclipse and no evidence of the stream's impact spot. The He II 4686 emission line light curve shows an eclipse centered on the continuum eclipse and of equal duration. The He II emission must be concentrated in the inner disk, which is contrary to all theoretical models. Futhermore, the He II radial velocity curve shows rotational motion centered on the eclipse, but the velocity is well below the expected Keplerian velocity. The He I emission line shows the expected double component structure due to an accretion disk, but the rotation velocity is three times larger than that of He II. Narrow He I absorption lines are seen which show no orbital motion. There is no evidence in any line for the hot spot's S wave, but a third H component is seen approx. 180 deg out-of-phase with the other emission lines. Dissert. Abstr.

N84-23409 California Inst. of Tech., Pasadena.
A SURVEY OF HALO RR LYRAE STARS Ph.D. Thesis
Abhijit Saha 1984 150 p
Avail: Univ. Microfilms Order No. DA8402495

A search for RR Lyrae stars has been conducted in selected regions of the Galactic halo, using the 48 inch Schmidt telescope at Palomar 29 RR Lyrae stars were found in three fields (each 42 square degrees). The faint limit for finding RR Lyraes is 19(m) 5 in B, and the faintest RR Lyrae stars that were found are at Galactocentric distances of over 40 kpc. Apart from a very few globular clusters, these stars are the most distant probes to the outer halo. Photoelectric photometry has been used to obtain accurate light curves and ephemerides for all the survey RR Lyrae stars. Spectrophotometry at minimum light has been used to estimate reddening and interstellar extinction. Distances to the individual RR Lyrae stars have been derived using the above. The space density of RR Lyrae stars has been traced out to a Galactocentric distance R of 33 kpc. Dissert. Abstr.

N84-23410 Pennsylvania State Univ., University Park.
H ALPHA AND TIO BAND OBSERVATIONS OF RS CVn STARS Ph.D. Thesis
Harold Lee Nations 1983 201 p
Avail: Univ. Microfilms Order No. DA8327532

The spectra of the most chromospherically active RS CVn stars are presented and analyzed. The H results include (1) the detection of 2 Peg of an episode of depressed H alpha emission lasting for three weeks; (2) the first determination of the relative H alpha emission strengths for the primary and secondary stars of the UX Ari system and a more accurate re-determination of

these values for HR 1099 (V711 Tau); a period of enhanced H alpha emission on BD + 61 deg 1211 (DMUMa); and extensive H alpha data for HD 155638 which shows that this star is considerably less active than the other stars surveyed. SZ Psc is shown to have undergone another H alpha emission outburst during 1981. The TiO band observations of 2 Peg show an enhancement of the 7100A feature near starspot minimum. Observations of a grid of G,K, and M giants were also obtained and used to calibrate a TiO equivalent width against spectral type and effective temperature. The STARSPOT computer program, which employs a geometry uniquely suited for the modeling of STARSPOTS on RS CVn stars was used to perform numerical experiments showing that harmonic analysis can be effectively used for the modeling of cool starspots. Dissert. Abstr.

N84-23411*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

FAR-IR SPECTROSCOPY OF THE GALACTIC CENTER: NEUTRAL AND IONIZED GAS IN THE CENTRAL 10 PC OF THE GALAXY

R. Genzel (California Univ., Berkeley), Dan M. Watson (California Inst. of Tech., Pasadena), C. H. Townes (California Univ., Berkeley), H. L. Dinerstein (Texas Univ., Austin), D. Hollenbach, D. F. Lester (Hawaii Univ., Honolulu), M. Werner, and J. W. V. Storey (New South Wales Univ., Kensington, Australia) Mar. 1983 27 p refs
(Grant NGR-05-003-511)
(NASA-CR-166510; NAS 1.26:166510) Avail: NTIS HC A03/MF A01 CSCL 03A

The 3P1 - 3P2 fine structure line emission from neutral atomic oxygen at 63 microns in the vicinity of the galactic center was mapped. The emission is extended over more than 4' (12 pc) along the galactic plane, centered on the position of Sgr A West. The line center velocities show that the O I gas is rotating around the galactic center with an axis close to that of the general galactic rotation, but there appear also to be noncircular motions. The rotational velocity at R is approximately 1 pc corresponds to a mass within the central pc of about 3 x 10(6) solar mass. Between 1 and 6 pc from the center the mass is approximately proportional to radius. The (O I) line probability arises in a predominantly neutral, atomic region immediately outside of the ionized central parsec of out galaxy. Hydrogen densities in the (O I) emitting region are 10(3) to 10(6) cm(-3) and gas temperatures are > or = 100 K. The total integrated luminosity radiated in the line is about 10(5) solar luminosity, and is a substantial contribution to the cooling of the gas. Photoelectric heating or heating by ultraviolet excitation of H2 at high densities (10(5) cm(-3)) are promising mechanisms for heating of the gas, but heating due to dissipation of noncircular motions of the gas may be an alternative possibility. The 3P1 - 3P0 fine structure line of (O III) at 88 microns toward Sgr A West was also detected. The (O III) emission comes from high density ionized gas (n 10(4) cm(-3)), and there is no evidence for a medium density region (n < 10(3) cm(-3)), such as the ionized halo in Sgr A West deduced from radio observations. This radio halo may be nonthermal, or may consist of many compact, dense clumps of filaments on the inner edges of neutral condensations at R > or = 2 pc. M.G.

N84-23412*# Smithsonian Astrophysical Observatory, Cambridge, Mass.

A NORMAL INCIDENCE, HIGH RESOLUTION X-RAY TELESCOPE FOR SOLAR CORONAL OBSERVATIONS Semiannual Progress Report, 1 Nov. 1983 - 30 Apr. 1984

Leon Golub Apr. 1984 67 p refs
(Grant NAGw-397)
(NASA-CR-173518; NAS 1.26:173518; SAR-3) Avail: NTIS HC A04/MF A01 CSCL 20F

A Normal Incidence high resolution X-ray Telescope is reported. The design of a telescope assembly which, after fabrication, will be integrated with the mirror fabrication process is described. The assembly is engineered to fit into the Black Brant rocket skin to survive sounding rocket launch conditions. A flight ready camera is modified and tested. E.A.K.

N84-23413*# California Univ., San Diego. Center for Astrophysics and Space Sciences.

INFRARED ASTRONOMY RESEARCH AND HIGH ALTITUDE OBSERVATIONS Final Report, 1973 - 1983

Barbara Jones, W. A. Stein, S. P. Willner, and B. T. Soifer Apr. 1984 32 p refs
(Grant NGR-05-005-055)
(NASA-CR-173526; NAS 1.26:173526) Avail: NTIS HC A03/MF A01 CSCL 03A

Highlights are presented of studies of the emission mechanisms in the 4 to 8 micron region of the spectrum using a circular variable filter wheel spectrometer with a PbSnTe photovoltaic detector. Investigations covered include the spectroscopy of planets, stellar atmospheres, highly obscured objects in molecular clouds, planetary nebulae, H2 regions, and extragalactic objects. A.R.H.

N84-23414*# California Univ., San Diego. Center for Astrophysics and Space Sciences.

PUBLICATIONS RESULTING FROM INFRARED ASTRONOMY RESEARCH AND HIGH ALTITUDE OBSERVATIONS Technical Report, 1973 - 1983

Barbara Jones, W. A. Stein, S. P. Wilner, and B. T. Soifer Apr. 1984 242 p
(Grant NGR-05-005-055)
(NASA-CR-173525; NAS 1.26:173525) Avail: NTIS HC A11/MF A01 CSCL 03A

Abstracts and/or reprints of 34 published reports of studies of the infrared emission of celestial bodies, molecular clouds, and interstellar matter are presented. A.R.H.

N84-23415*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

DOCUMENTATION FOR THE MACHINE-READABLE VERSION OF A SUPPLEMENT TO THE BRIGHT STAR CATALOGUE (HOFFLEIT, SALADYGA AND WLASUK 1983)

Wayne H. Warren, Jr. Feb. 1984 24 p refs
(NASA-TM-85573; NSSDC/WDC-A-R&S-84-04; NAS 1.15:85573) Avail: NTIS HC A02/MF A01 CSCL 03A

Detailed descriptions of the three files of the machine-readable catalog are given. The files of the original tape have been restructured and the data records reformatted to produce a uniform data file having a single logical record per star and homogeneous data fields. The characteristics of the tape version as it is presently being distributed from the Astronomical Data Center are given and the changes to the original tape supplied are described. Author

N84-23416*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

DOCUMENTATION FOR THE MACHINE-READABLE VERSION OF THE CATALOGUE OF 20457 STAR POSITIONS OBTAINED BY PHOTOGRAPHY IN THE DECLINATION ZONE -48 DEG TO -54 DEG (1950)

Wayne H. Warren, Jr. Dec. 1983 14 p refs
(NASA-TM-85572; NSSDC/WDC-A-R&S-83-19; NAS 1.15:85572) Avail: NTIS HC A02/MF A01 CSCL 03A

The machine readable catalog, as it is distributed from the Astronomical Data Center, is described. Some minor reformatting of the magnetic tape version is received to decrease the record size and conserve space; the data content is identical to the sample shown in Table VI of the source reference. E.A.K.

N84-23417*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

DOCUMENTATION FOR THE MACHINE-READABLE VERSION OF A TABLE OF REDSHIFTS FOR ABELL CLUSTERS (SARAZIN, ROOD AND STRUBLE 1982)

Wayne H. Warren, Jr. Nov. 1983 14 p refs
(NASA-TM-85571; NSSDC/WDC-A-R&S-83-18; NAS 1.15:85571) Avail: NTIS HC A02/MF A01 CSCL 03A

The machine readable catalog is described. The machine version contains the same data as the published table, which

includes a second file with the notes. The computerized data files are prepared at the Astronomical Data Center. Detected discrepancies and cluster identifications based on photometric estimators are included. E.A.K.

N84-23418*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DOCUMENTATION FOR THE MACHINE-READABLE VERSION OF THE SAO-HD-GC-DM CROSS INDEX VERSION 1983
Nancy G. Roman, Wayne H. Warren, Jr., and Norman Schofield, Jr. Dec. 1983 18 p refs
(NASA-TM-85570; NSSDC/WDC-A-R&S-83-17; NAS 1.15:85570) Avail: NTIS HC A02/MF A01 CSCL 03A

An updated and extended machine readable version of the Smithsonian Astrophysical Observatory star catalog (SAO) is described. A correction of all errors which were found since preparation of the original catalog which resulted from misidentifications and omissions of components in multiple star systems and missing Durchmusterung numbers (the common identifier) in the SAO Catalog are included and component identifications from the Index of Visual Double Stars (IDS) are appended to all multiple SAO entries with the same DM numbers, and lower case letter identifiers for supplemental BD stars are added. A total of 11,398 individual corrections and data additions is incorporated into the present version of the cross index. E.A.K.

N84-23419*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DOCUMENTATION FOR THE MACHINE-READABLE VERSION OF THE SMITHSONIAN ASTROPHYSICAL OBSERVATORY STAR CATALOGUE (SAO) VERSION 1984
Nancy G. Roman and Wayne H. Warren, Jr. Jan. 1984 25 p refs
(NASA-TM-85574; NSSDC/WDC-A-R&S-84-02; NAS 1.15:85574) Avail: NTIS HC A02/MF A01 CSCL 03A

An updated, corrected and extended machine readable version of the Smithsonian Astrophysical Observatory star catalog (SAO) is described. Published and unpublished errors discovered in the previous version have been corrected, and multiple star and supplemental BD identifications added to stars where more than one SAO entry has the same Durchmusterung number. Henry Draper Extension (HDE) numbers have been added for stars found in both volumes of the extension. Data for duplicate SAO entries (those referring to the same star) have been blanked out, but the records themselves have been retained and flagged so that sequencing and record count are identical to the published catalog. E.A.K.

N84-23420*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DOCUMENTATION FOR THE MACHINE-READABLE VERSION OF THE GENERAL CATALOGUE OF 33342 STARS FOR THE EPOCH 1950 (BOSS 1937)
Nancy G. Roman and Wayne H. Warren, Jr. Dec. 1983 15 p refs
(NASA-TM-85568; NSSDC/WDC-A-R&S-83-07; NAS 1.15:85568) Avail: NTIS HC A02/MF A01 CSCL 03A

A revised and corrected version of the machine-readable catalog has been prepared. Cross identifications of the GC stars to the HD and DM catalogs have been replaced by data from the new SAO-HD-GC-DM Cross Index (Roman, Warren and Schofield 1983), including component identifications for multiple SAO entries having identical DM numbers in the SAO Catalog, supplemental Bonner Durchmusterung stars (lower case letter designations) and codes for multiple HD stars. Additional individual corrections have been incorporated based upon errors found during analyses of other catalogs. Author

N84-23421*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DOCUMENTATION FOR THE MACHINE-READABLE VERSION OF THE SURVEY OF THE ASTROGRAPHIC CATALOGUE FROM 1 TO 31 DEGREES OF NORTHERN DECLINATION (FRESNEAU 1983)
Wayne H. Warren, Jr. Nov. 1983 11 p
(NASA-TM-85569; NAS 1.15:85569; NSSDC/WDC-A-R&S-83-16) Avail: NTIS HC A02/MF A01 CSCL 03A

A description of the machine readable catalog, including detailed format and tape file characteristics, is given. The machine file is a computation of mean values for position and magnitude at a mean epoch of observation for each unique star in the Oxford, Paris, Bordeaux, Toulouse and Northern Hemisphere Algiers zone. The format was changed to effect more efficient data searching by position and additional duplicate entries were removed. The final catalog contains data for 997311 stars. M.A.C.

N84-23422# Cambridge Univ. (England). Inst. of Astronomy.
[ACTIVITIES REPORT OF THE INSTITUTE OF ASTRONOMY] Annual Report, 1982-1983
1983 42 p refs
Avail: NTIS HC A03/MF A01

Stellar, galactic, quasar, cluster, supernovae, cosmology, relativity, arid fluid mechanics research is summarized. Astronomical instrument modifications are described. Author (ESA)

N84-23382# Naval Sea Systems Command, Washington, D.C.
SELECTION OF MULTIPLE SOURCES IN WEAPON SYSTEMS ACQUISITION Final Report
J. W. Hargrove, Jr. *In* AF Business Research Management Center Proc. of the Fed. Acquisition Res. Symp. with Theme 1983 p 533-536 (For primary document see N84-23293 13-81)
(AD-P002837) Avail: NTIS HC A24/MF A01 CSCL 15/5

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N84-23423 California Univ., Berkeley.
SHOCK WAVES AND MASS OUTFLOW IN THE ORION MOLECULAR CLOUD: OBSERVATIONS OF FAR-INFRARED EMISSION LINES OF CARBON MONOXIDE, HYDROXYL AND AMMONIA Ph.D. Thesis
Dan Martin Watson 1983 101 p
Avail: Univ. Microfilms Order No. DA8329091

A high-resolution far-infrared spectrometer was designed, constructed and used for the detection of several far-infrared emission lines of CO, OH and NH3. The spectrometer operates in the 36-180 microns wavelength range and is capable of providing spectral resolution of one part in 5000. Observations of the region in the center of the Orion molecular cloud which contains the Kleinmann/Low nebula, using the instrument mentioned above, resulted in detections of emission that represent the first detections of interstellar molecules at far-infrared wavelengths. The CO and OH lines arise in hot, shock-excited gas previously detected in the infrared lines of molecular hydrogen at two microns and 12 microns. Dissert. Abstr.

N84-23424 Princeton Univ., N. J.
THE LUMINOSITY FUNCTION OF GALAXIES IN CO-12 Ph.D. Thesis
Frances Ann Verter 1983 128 p
Avail: Univ. Microfilms Order No. DA8402671

This thesis establishes a foundation for studies of relationships between the total (12)CO J = 1-0 emission of galaxies and other global properties. A sensitive survey of a galaxy sample covering a wide range of luminosities and morphological types is combined with all other available observations of (12)CO in galaxies and the total emission of this sample is extrapolated by modelling the galaxies with an exponential radial profile. A maximum likelihood luminosity function that incorporates both fluxes and flux upper limits is applied to the extrapolated sample. The average luminosity is highest for galaxies of intermediate morphological type. The Appendices to this thesis are a catalog of information on all published (12)CO observations of galaxies, including a bibliography,

a summary of data on the observed galaxies, a comparison of calibration conventions, and a list of the CO distributions of mapped galaxies. Dissert. Abstr.

N84-23425 Michigan Univ., Ann Arbor.
DYNAMICS AND EVOLUTION OF cD GALAXIES Ph.D. Thesis
Eliot Mark Malumuth 1983 253 p
Avail: Univ. Microfilms Order No. DA8402324

The brightest members of clusters of galaxies (BCMs) have a remarkably small dispersion (about 0.35 mag) in luminosity. The reason may be the BCM galaxies (in particular those classified as cD galaxies) are formed by some special process at work within a cluster, or it may be that these galaxies are drawn from an elliptical galaxy luminosity function with a sharp cutoff at the bright end. This thesis examines the BCM galaxies with the aim of distinguishing between these two competing pictures. Spectra have been obtained and a fourier quotient method used to determine velocity dispersions for 46 BCM galaxies and 31 elliptical galaxies. CCD photometry was obtained to measure the surface brightness profiles of 27 BCM galaxies. It was found that the BCM galaxies are on average about 1.0 magnitude brighter than the E galaxies at the same velocity dispersion. The effective radius is largest and the effective surface brightness is lowest for the BCM galaxies which have the largest difference between their luminosities and the luminosities of E galaxies with the same velocity dispersion. Dissert. Abstr.

N84-23426 Princeton Univ., N. J.
DYNAMICAL RELAXATION IN STELLAR SYSTEMS Ph.D. Thesis
John Jeremy Goodman 1983 186 p
Avail: Univ. Microfilms Order No. DA8402685

This dissertation contains three papers concerning dynamical relaxation in stellar systems. Paper 1 explores the importance of large-angle two-body encounters for late core collapse when less than one hundred particles remain in the core. A formula is given for the rate of finite-angle scatterings by an arbitrary field-star distribution, and an orbit-averaged equation for the evolution of the system is derived from it by assuming that the particles have equal mass and isotropically distributed velocities. In Paper 2, the evolution of a stellar system long after core collapse is studied using a gas model. A one-parameter sequence of near-homologous solutions is found, parameterized by the rate of ejection of mass from the center. Paper 3 develops an orbit-averaged Fokker-Planck equation for axisymmetric systems. Calculations based on this equation show that self-similar core collapse is not impeded by rotation, although the central angular velocity increases as a small power of central density. Dissert. Abstr.

N84-22783# Joint Publications Research Service, Arlington, Va.
CENTRAL BURST OF SIMULTANEOUSLY ROTATING AND GRAVITATING BODY Abstract Only
A. N. Golubyatnikov and T. I. Chilachava *In its* USSR Rept.: Eng. and Equipment (JPRS-UEQ-84-004) 17 Apr. 1984 p 9 Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 273, no. 4, Dec. 1983 p 825-829 (For primary document see N84-22772 13-31)
Avail: NTIS HC A03/MF A01

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights. For spacecraft design see *18 Spacecraft Design Testing, and Performance.* For space stations see *15 Launch Vehicles and Space Vehicles.*

N84-23427 Michigan Univ., Ann Arbor.
MARTIAN PALEOCLIMATE Ph.D. Thesis
Susan Elaine Postawko 1983 147 p
Avail: Univ. Microfilms Order No. DA8402360

A model is developed which includes very detailed radiation calculations and meridional transport of heat. Results show that carbon dioxide alone will not produce the necessary warming. Maximum equatorial temperatures are some 20 K below the freezing point of water. High latitude temperatures are warm enough so that polar CO2 ice caps will not form. Calculations were also carried out for predominantly CO2 atmospheres which contained water vapor. When a reduced solar flux of 75%, the present value, is taken into consideration, as was likely the case for early Mars, all calculated surface temperatures fall well below 273 K. If the greenhouse effect was responsible for the surface temperatures on Mars early in the planet's history, gases other than carbon dioxide and water were present. Dissert. Abstr.

N84-23428 Arizona Univ., Tucson.
THEORETICAL PREDICTIONS FOR THE PHASE STABILITY OF DENSE BINARY MIXTURES Ph.D. Thesis
Joseph John MacFarlane 1983 89 p
Avail: Univ. Microfilms Order No. DA8401268

A new approach is developed for evaluating the mixing properties of binary solutions at high pressure. This involves solving Poisson's equation throughout three-dimensional cubic lattices, consistent with Thomas-Fermi-Dirac (TFD) theory. Zero temperature calculations are carried out for a variety of compositions and crystal structures in 3 pressure groups relevant to Jovian planetary interiors. Pseudopotentials based on the two-component-plasma model (with a uniform electron background) are fitted to the solid-state results, and are then used in liquid-state calculations using hard-sphere perturbation theory. TFD results if H-He solutions find critical temperatures (above which all compositions are soluble) to be approx. 0.500, and 1500 K at pressures of 10, 100, and 1000 Mbar, respectively. These temperatures are much lower than those obtained using free electron perturbation theory, where T sub crit approx. 10,000 K at 10 Mbar. Dissert. Abstr.

N84-23429 Massachusetts Univ., Amherst.
MM-WAVELENGTH MEASUREMENTS OF CO IN THE ATMOSPHERE OF MARS AND SO2 IN THE ATMOSPHERE OF VENUS Ph.D. Thesis
John Conrad Good 1983 155 p
Avail: Univ. Microfilms Order No. DA8401065

Millimeter wavelength spectra of CO on Mars are used to determine both its abundance and the temperature profile in the atmosphere. Two different lines (CO(J = 1.0) and CO(J = 2.1) are required to do this unambiguously since it is found that the abundance derived is extremely dependent on the form of the atmospheric temperature profile chosen. On Venus, the study of the chemistry of the omnipresent sulfuric acid clouds would likewise benefit from an accurate measurement of the abundance of sulfur compounds and particularly of SO2, the major sulfur bearing compound in the region below the clouds. Constraints on the abundance profile of SO2 on Venus are made via an interferometric measurement of the amount of limb darkening at 3.4 mm. Hypothetical SO2 profiles were modeled and it was found that the large SO2 abundance measured by the Pioneer Venus entry probes in the lower atmosphere must begin to decrease well below the bottom of the lower cloud, indicating that a destruction mechanism for SO2 exists in this region. Dissert. Abstr.

N84-23430*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE REACTION NH2 + PH3 YIELDS NH3 + PH2: ABSOLUTE RATE CONSTANT MEASUREMENT AND IMPLICATION FOR NH3 AND PH3 PHOTOCHEMISTRY IN THE ATMOSPHERE OF JUPITER
S. R. Bosco, W. D. Brobst, D. F. Nava, and L. J. Stief Jun. 1983 28 p refs Previously announced in IAA as A83-49343
(NASA-TM-85063; NAS 1.15:85063) Avail: NTIS HC A03/MF A01 CSCL 03B

The rate constant is measured over the temperature interval 218-456 K using the technique of flash photolysis-laser-induced fluorescence. NH2 radicals are produced by the flash photolysis of ammonia highly diluted in argon, and the decay of fluorescent

NH2 photons is measured by multiscaling techniques. For each of the five temperatures employed in the study, the results are shown to be independent of variations in PH3 concentration, total pressure (argon), and flash intensity. It is found that the rate constant results are best represented for T between 218 and 456 K by the expression k = (1.52 + or - 0.16) x 10 to the -12th exp(-928 + or - 56/T) cu cm per molecule per sec; the error quoted is 1 standard deviation. This is the first determination of the rate constant for the reaction NH2 + PH3. The data are compared with an estimate made in order to explain results of the radiolysis of NH3-PH3 mixtures. The Arrhenius parameters determined here for NH2 + PH3 are then constrasted with those for the corresponding reactions of H and OH with PH3. IAA

N84-23431*# National Aeronautics and Space Administration, Washington, D. C.
REPORTS OF PLANETARY GEOLOGY PROGRAM, 1983
Henry E. Holt, comp. Apr. 1984 350 p refs
(NASA-TM-86246; NAS 1.15:86246) Avail: NTIS HC A15/MF A01 CSCL 03B

Several areas of the Planetary Geology Program were addressed including outer solar system satellites, asteroids, comets, Venus, cratering processes and landform development, volcanic processes, aeolian processes, fluvial processes, periglacial and permafrost processes, geomorphology, remote sensing, tectonics and stratigraphy, and mapping. For individual titles, see N84-23432 through N84-23542.

N84-23432*# Massachusetts Univ., Amherst. Dept. of Geology and Geography.
ICE-COVERED VOLCANIC WATER FLOWS ON GANYMEDE
M. Lee Allison and Stephen M. Clifford (Massachusetts Univ.) *In* NASA. Washington Repts. of Planetary Geol. Program Apr. 1984 p 3-5 refs (For primary document see N84-23431 13-91) (Grant NsG-7405)
Avail: NTIS HC A15/MF A01 CSCL 03B

The most geologically reasonable model for the origin of grooved terrain on Ganymede involves flooding of a planetary graben system by water or water-ice magmas that rose to the surface along normal faults in the rift zones. To investigate this process further, the thermal evolution of a water flow on Ganymede's surface was examined. The model is a variation of earlier work on ice-covered water flows. It is based on the simplifying assumptions that laminar flow and a concomitant solid ice cover are achieved relatively soon after eruption; and that the amount of energy lost to the substratum is negligible. Author

N84-23433*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ORIGIN AND EVOLUTION OF THE SATURN SYSTEM
James B. Pollack and Guy Consolmagno (MIT) *In* NASA. Washington Repts. of Planetary Geol. Program Apr. 1984 p 6-7 (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 03B

As was the case for Jupiter, Saturn formed either as a result of a gas instability within the solar nebula or the accretion of a solid core that induced an instability within the surrounding solar nebula. In either case, the proto-planet's history is divided into three major stages: early, quasi-hydrostatic evolution (stage 1); hydrodynamical collapse (stage 2); and late, quasi-hydrostatic contraction (stage 3). During stage 1, Saturn had a radius of several hundred times that of its present radius, R(s), while stage 3 began when Saturn had a radius of 3.5 R(s). Stages 1 and 2 lasted 10(6) to 10(7) years and 1 year, respectively, while stage 3 is continuing through the present epoch. During the early history of the Saturn system, giant impact events may have catastrophically disrupted most of the original satellites of Saturn. Such disruption, followed by reaccretion, may be responsible, in part for the occurrence of Trojans and co-orbital moons in the Saturn system, the apparent presence of a stochastic component in the trend of satellite density with radial distance, and the present population of ring particles. Author

N84-23434*# National Research Council of Canada, Ottawa (Ontario). Inst. of Astrophysics.
THE LAPLACIAN RESONANCE AND TIDAL DISSIPATION
A. F. Cook (Smithsonian Astrophysical Observatory) *In* NASA. Washington Repts. of Planetary Geol. Program Apr. 1984 p 8-10 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 03B

The Laplacian resonance amongst Io, Europa, and Ganymede was examined, taking into account tidal dissipation in Jupiter, Io and Europa. In equilibrium, it is not possible to neglect dissipation in Europa nor the torques of Jupiter on Europa and Ganymede. A formal calculation was made on the assumption that the tidal torques and the torques in orbit-orbit resonance reached an equilibrium such that the rates of decrease of the mean motions of the satellites are in the ratios 4:2:1. Q(j)/k(j)=167 Q(1)/k(1), Q(2)/k(2) = 0.44 Q(1)/K(1), where Q denotes the quality at the body's frequency of rotation, k its second degree Love number and the subscripts J, 1 and 2 denote Jupiter, Io, and Europa. The Q(J) found is at Jupiter's frequency of rotation. The rate of tidal dissipation in Europa comes to 1/5 that of Io. Such a low value of Q(2)/K(2) is plausible if dissipation in both Io and Europa is due to tidal friction in fluid against underlying and overlying solid layers. B.G.

N84-23435*# Geological Survey, Menlo Park, Calif.
THE STRUCTURE OF THE IONIAN LITHOSPHERE
Michael H. Carr and Gary D. Clow *In* NASA. Washington Repts. of Planetary Geol. Program Apr. 1984 p 11-13 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 03B

Exploratory work on the structure of the Ionian lithosphere is reported. The approach is to examine temperature profiles within the lithosphere that result from different distributions of sulfur and silicates and different conductive heat fluxes, then compare such profiles with observations in the expectation that only a limited set of the profiles are possible. In this preliminary work some rather simplistic assumptions were taken and the report should be viewed more as a demonstration of a method rather than a presentation of results. Author

N84-23436*# Arizona Univ., Tucson. Lab. for Storm, Lunar and Planetary Science.
MODELING IO VOLCANISM: MAXIMUM VOLCANIC TEMPERATURES, DEPTHS OF MELTING AND MAGMA COMPOSITION
Larry S. Crumpler and Robert G. Strom *In* NASA. Washington Repts. of Planetary Geol. Program Apr. 1984 p 14-16 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 03B

Interim results of thermal and structural modeling of volcanism on Io were presented. The final results of the modeling are summarized. The basic analysis is an evaluation of the magma trigger mechanism for initiating and maintaining eruptions. Secondary aspects include models of the mechanical mode of magma emplacement, interactions with a sulphur-rich upper crust, and more speculative implications for Io's volcanism. Author

N84-23437*# North Dakota Univ., Grand Forks. Dept. of Geology.
VOLCANIC FORMS IN THE KANE PATERA REGION, IO
Frank R. Karner *In* NASA. Washington Repts. of Planetary Geol. Program Apr. 1984 p 17-19 (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 03B

Four morphologically distinct major volcanic forms occur within and adjacent to the Kane Patera, high resolution map quadrangle Ji2B (lat 15 to 50 S., long 355 to 20 W.). Volcanic vents and flows from four types of features are included: low-relief shield volcanoes, domical shield volcanoes, large calderas and isolated groups of flows not obviously associated with a central vent. Author

N84-23438*# Cornell Univ., Ithaca, N.Y.
PHOTOMETRY OF ICY SATELLITES: HOW IMPORTANT IS

MULTIPLE SCATTERING IN DILUTING SHADOWS?
B. Buratti and J. Veverka *In* NASA. Washington Repts. of Planetary Geol. Program Apr. 1984 p 20-22 refs (For primary document see N84-23431 13-91)
(Grant NsG-7156)
Avail: NTIS HC A15/MF A01 CSCL 03B

Voyager observations have shown that the photometric properties of icy satellites are influenced significantly by large-scale roughness elements on the surfaces. While recent progress was made in treating the photometric effects of macroscopic roughness, it is still the case that even the most complete models do not account for the effects of multiple scattering fully. Multiple scattering dilutes shadows caused by large-scale features, yet for any specific model it is difficult to calculate the amount of dilution as a function of albedo. Accordingly, laboratory measurements were undertaken using the Cornell Goniometer to evaluate the magnitude of the effect. Author

N84-23439*# Cornell Univ., Ithaca, N.Y.
COMPARISON OF HAPKE'S PHOTOMETRIC THEORY WITH VOYAGER OBSERVATIONS OF EUROPA, ENCELADUS, RHEA AND MIMAS
B. Buratti and J. Veverka *In* NASA. Washington Repts. of Planetary Geol. Program Apr. 1984 p 23-25 refs (For primary document see N84-23431 13-91)
(Grant NsG-7156)
Avail: NTIS HC A15/MF A01 CSCL 03B

Voyager imaging observations of the satellites of Jupiter and Saturn provide an excellent test for various photometric theories that were proposed to describe the scattering properties of planetary and satellite surfaces. Not only does the Voyager data set include observations of surfaces ranging widely in albedo, but it provides measurements (in both disc-integrated and disc-resolved forms) over a wide range of phase angles. A detailed comparison of the above models with Voyager data for Europa, Enceladus, Rhea, and Mimas was described. These satellites were selected because they cover a range of reflectances from 0.65 to 1.0 and because for them the Voyager photometric data sets are most complete. Author

N84-23440*# Hawaii Univ., Honolulu. Inst. for Astronomy.
VOYAGER FEATURE-FIXED PHOTOMETRY OF IAPETUS Abstract Only
J. Goguen, D. Morrison, and M. Tripicco *In* NASA. Washington Repts. of Planetary Geol. Program Apr. 1984 p 26 (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 03B

Iapetus is one of the most mysterious objects in the Solar System. As indicated by previous ground-based studies and dramatically confirmed by the Voyager images, the surface of this satellite has a strikingly bimodal distribution of albedo and color. While the underlying object seems to be a largely icy satellite similar to Rhea, the leading hemisphere of Iapetus is dominated by a very dark patch of hemispheric scale. The symmetry of this dark material with respect to the orbital motion of the satellite strongly suggests an external control, if not necessarily an external origin, for the dark material. Quantitative photometric techniques are used to map the photometric function of the surface of the material over Iapetus. The approach is to study clearly defined surface areas that appear on a number of Voyager images obtained under different spacecraft and lighting geometries. Author

N84-23441*# Lancaster Univ. (England). Dept. of Environmental Sciences.
THEORETICAL ASPECTS OF PHOTOCLINOMETRIC TERRAIN PROFILING ON THE GALILEAN SATELLITES
Lionel Wilson, Marion A. Brown, E. M. Parmentier (Brown Univ.), and J. W. Head (Brown Univ.) *In* NASA. Washington Repts. of Planetary Geol. Program Apr. 1984 p 27-28 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 03B

For large parts of the surfaces of the Galilean satellites there is no stereoscopic high resolution imagery, and so for shadow-free regions far from the terminator, the only method of obtaining topograpic information is photoclinometry, the technique of converting brightness variations into local surface tilts and hence into topographic profiles and contour maps. The conversion from brightness changes to slopes require knowledge of the angular photometric function for the type of planetary surface terrain being analyzed, i.e., the relationship describing the brightness of the surface as a function of the angles of incidence (I) and emergence (E) of light at a surface element. In order to investigate the effects of these changes on the shapes of topographic profiles deduced from the functions, an area of grooved terrain (lines 500-505, samples 550-650 on frame 20640.27 0060J2) using wide ranges of values of all the adjustable parameters in Hapke's new photometric function were analyzed. Author

N84-23442*# California Inst. of Tech., Pasadena. Div. of Geological and Planetary Sciences.
TOPOGRAPHY ON GANYMEDE DERIVED FROM PHOTOCLINOMETRY
G. E. Danielson *In* NASA. Washington Repts. of Planetary Geol. Program Apr. 1984 p 29-31 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 03B

A fundamental limitation in the quantitative analysis of planetary geomorphology and structural geology results from the absense of topographic data. Among the studies that might be addressed, were such data available, are volumetric and slope relationships of Ionian volcanics, fracture and annealing processes in icy crusts on Europa and Ganymede, and evaluation of viscous relaxation as a means of degrading landforms on Europea, Ganymede, and Callisto. A technique for acquiring topographic data on the Galilean satellites using photoclinometry was developed and applied. Author

N84-23443*# Hawaii Inst. of Geophysics, Honolulu. Planetary Geosciences Div.
NEW MODELS FOR LANDFORM EVOLUTION ON IO
Peter J. Mouginis-Mark, James L. Whitford-Stark (Sul Ross State Univ.), and James W. Head (Brown Univ.) *In* NASA. Washington Repts. of Planetary Geol. Program Apr. 1984 p 32-33 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 03B

As part of the Galilean Satellites Mappers Program, the South Polar region of Io was studied. Examination of the Voyager images had led to reassessment of the possible mechanisms by which certain units were created or modified in this area. Specifically, analyses have focused on determining the relative age of the mountain material and on the process by which the layered plains material was eroded. Author

N84-23444*# California Inst. of Tech., Pasadena.
GEOLOGY OF DIONE
J. B. Plescia *In* NASA. Washington Repts. of Planetary Geol. Program Apr. 1984 p 34-36 (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 03B

Dione is one of the most geologically complex of the Saturnian satellites. Crater counts and surface morphology indicates the geologic units observed are of variable age and origin. In an attempt to understand the processes which have affected Dione, a geologic map was prepared. Several geologic units were identified; ancient heavily cratered terrain, two plains units: cratered plains and lightly cratered plains, lobate deposits, crater rim deposits and bright wispy materials. Author

N84-23445*# Geological Survey, Flagstaff, Ariz.
EVOLUTION OF THE URANUS-NEPTUNE PLANETESIMAL SWARM: CONSEQUENCES FOR THE EARTH Abstract Only
Eugene M. Shoemaker and Ruth F. Wolfe *In* NASA. Washington Repts. of Planetary Geol. Program Apr. 1984 p 37 (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 03B

The evolution of planetesimals in the outer Solar System were

evaluated, both stellar and planetary encounters. About 20% of the Uranus-Neptune planetesimals (UNP's) enter the comet cloud and are stored primarily in the region inside the observational limits of the Oort cloud. Half of the comets have survived to the present time; the cloud now has a mass of the order of Jupiter's mass. Most UNP's are ejected from the Solar system, and about half of the planetesimal swarm is passed to the control of Jupiter prior to ejection. Jupiter's perturbations drive a large flux of these planetesimals into Earth-crossing orbits, and it now appears highly probable that UNP's account for most of the heavy bombardment of the Moon and Earth. Author

N84-23446*# Geological Survey, Flagstaff, Ariz.
HIGH-RESOLUTION COLOR IMAGES OF IO
Alfred S. McEwen and Laurence A. Soderblom *In* NASA. Washington Repts. of Planetary Geol. Program Apr. 1984 p 38 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 03B

Color versions of the highest resolution Voyager images of Io were produced by combining the low resolution color images with the high resolution, clear filter images. High resolution versions of the orange, blue, and violet filter images are produced by: orange = high-res clear * [low-res orange / low-res clear] blue = high-res clear * [low-res blue / low-res clear] violet = high-res clear * [low-res violet / low-res clear]. The spectral responses of the high and low resolution clear filter images cancel, leaving the color, while the spatial frequencies of the two low resolution images cancel, leaving the high resolution. Author

N84-23447*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SHORT TIME-SCALE SURFACE CHANGES ON IO
Richard J. Terrile *In* NASA. Washington Repts. of Planetary Geol. Program Apr. 1984 p 39-40 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 03B

Imaging data from the Voyager 1 and 2 encounters with the Jupiter system provide a data set for the examination of short time-scale variations of surface features on Io. Clear evidence exists for variations near the known eruption sites and for other areas which appeared to have erupted between the encounters. Regions outside the known active eruption sites were examined in order to look for variations in the surface scattering properties which is due to undetected small-scale volcanic activity. The phase functions of many areas are intercompared in order to look for regions with phase functions outside the normal range for satellite surface properties. Areas with unusual scattering properties are related to small-scale eruptions of gas or particles. Determination of the distribution of these areas has strong implications for the resurfacing rates for Io. Author

N84-23448*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
GEOLOGIC STUDIES OF OUTER SOLAR SYSTEM SATELLITES: IAPETUS AND EUROPA
S. W. Squyres and R. T. Reynolds *In* NASA. Washington Repts. of Planetary Geol. Program Apr. 1984 p 41-43 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 03B

A model of regolith evolution on bodies subjected to an asymmetric impact flux is presented. The general effect of an asymmetric impact flux is ballistic diffusion of regolith from areas of high impact flux to areas of lower flux. The effect is most pronounced on low gravity bodies where ejecta travel distances are large, and on bodies with strong flux asymmetries. It may be especially important on Iapetus, where retrograde debris from Phoebe striking the leading hemisphere may produce a flux asymmetry as large as 100 to 1 from apex to antapex. We find that the net amount of material transported by ballistic diffusion is inversely proportional to satellite density. Theoretical calculations and Voyager observations support the view that tidal heating is sufficient to maintain a liquid layer throughout the history of Europa. Photosynthetic, thermal, electrical, and chemical energy sources are considered. The calculations suggest that there may be regions on Europa, very limited in space and time, with physical conditions that are within the range of adaptation of life on Earth. Calculations for the electrical currents within Europa for a thick ice crust are very small. M.A.C.

N84-23449*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE PLANET CROSSING ASTEROID SURVEY: PROGRESS IN THE ANALYSIS OF POPULATIONS AND TERRESTRIAL-PLANET CRATERING RATES
Eleanor F. Helin and R. Scott Dunbar *In* NASA. Washington Repts. of Planetary Geol. Program Apr. 1984 p 47-50 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 03B

The Planet-Crossing Asteroid Survey (PCAS) is making steady progress toward the accumulation of the data required to make improved estimates of the populations and cratering rates which can be compared with the existing record of impact events. The PCAS is the chief source of new objects on which to base these calculations over the past decade, and is an integral part of the continuing refinement of the estimates used in planetological applications. An adjunct effort to determine albedo statistics from photometry of UCAS plates is being pursued as well, to better define the magnitude frequency distributions of asteroids. This will improve the quality of the population and collision probability calculations. The survey effort continues to discover new asteroids whose orbital characteristics may reveal the origin and evolution mechanisms reponsible for the transport of the planet-crossing asteroids to the inner solar system. M.A.C.

N84-23450*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
COMETARY NUCLEUS AND ACTIVE REGIONS
Fred L. Whipple *In* NASA. Washington Repts. of Planetary Geol. Program Apr. 1984 p 51-53 (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 03B

On the basis of the icy conglomerate model of cometary nuclei, various observations demonstrate the spotted nature of many or most nuclei, i.e., regions of unusual activity, either high or low. Rotation periods, spin axes and even precession of the axes are determined. The observational evidence for variations in activity over the surfaces of cometary nuclei are listed and discussed. On June 11 the comet IRAS-ARAKI-ALCOCK approached the Earth to a distance of 0.031 AU, the nearest since C/Lexell, 1770 I, providing a unique opportunity for near-nucleus observations. Preliminary analysis of these images establishes the spin axis of the nucleus, with an oblioquity to the orbit plane of approximately 50 deg, and a lag angle of sublimation approximately 35 deg from the solar meridian on the nucleus. Asymmetries of the inner coma suggests a crazy-quilt distribution of ices with differing volatility over the surface of the nucleus. The observations of Comet P/Homes 1892 III, exhibiting two 8-10 magnitude bursts, are carefully analyzed. The grazing encounter produced, besides the first great burst, an active area on the nucleus, which was rotating retrograde with a period of 16.3hr and inclination nearly 180 deg. After the first burst the total magnitude fell less than two magnitudes from November 7 to November 30 (barely naked eye) while the nuclear region remained diffuse or complex, rarely if ever showing a stellar appearance. The fading was much more rapid after the second burst. The grazing encounter distributed a volume of large chunks in the neighborhood of the nucleus, maintaining activity for weeks. M.A.C.

N84-23451*# Hawaii Inst. of Geophysics, Honolulu. Planetary Geosciences Div.
A GENERALIZED BEHAVIORAL MODEL FOR ROTATING SHORT PERIOD COMETS WITH SPECTRAL ORBITAL ELEMENTS AND AXIAL ORIENTATION
F. P. Fanale and J. R. Salvail *In* NASA. Washington Repts. of Planetary Geol. Program Apr. 1984 p 54-55 (For primary document see N84-23431 13-91)

Avail: NTIS HC A15/MF A01 CSCL 03B

A generalized model for short period comets is developed which integrates in a fairly rigorous manner the isolation history of regions on rotating comets with specified axial orientation and the complex feedback, processes involving heat, gas and dust transport, dust mantle development and coma opacity. Attention is focused on development, reconfiguration and partial or complete launching of dust mantles and the reciprocal effects of these three processes on ice surface temperature and gas and dust production. The dust mantle controls the H2O flux not only by its effect on the temperature at the ice interface but (dominantly) by its dynamic stability which strongly influences vapor diffusivity. The model includes the effects of latitude, rotation and spin axis orientation are included and applied to an initially homogeneous sphere of H2O ice and silicate using the orbital parameters of comet Encke. Numerous variations of the model, using combinations of grain size distribution, dust-to-ice ratio, latitude and spin axis orientation, are presented and discussed. Resulted for a similar nonrotating, constant Sun orientation models are also included. M.A.C.

N84-23452*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

PROPERTIES OF SIMULATED COMET MANTLE

Frazer P. Fanale (Hawaii Univ.), Stephen Saunders, Bruce Banerdt, James Stephens, Eric Laue, and Steve Sutton (Michingan Univ.) *In* NASA. Washington Repts. of Planetary Geol. Program Apr. 1984 p 56-58 (For primary document see N84-23431 13-91)

Avail: NTIS HC A15/MF A01 CSCL 03B

The properties of freeze-dried dilute dispersions of dust in water ice are of considerable interest in studies of comet nucleus mantles. The formation of a rind residue produced by the sublimation of water ice containing various amounts of fine clay particles may be an important process. A simulation of the development of the dry dust rind on the surface of comets is presented. This rind is the result of preferential ice sublimation. The development and disruption of this rind and its subsequent levitation by water vapor flow is studied. The most interesting rind simulant is produced by dispersing 0.1 micron particles of montmorillonite in water in concentrations of 10%, 1%, and 0.1%. These dispersions are then sprayed into liquid nitrogen in the form of 100 micron droplets. The frozen droplets are then freeze-dried in a vacuum which prevents the ice temperature from rising above -30 C. Sublimation of the nitrogen and the water produced dry rinds. The most striking result was the development of large cohesive matrices of individual clay particles, and in some cases a continuous cohesive crust. Scanning electron microscope (SEM) observations reveal that the material formed by freeze-drying the 0.1% dispersion does not retain the original spherical shape of the sprayed 100 micron droplets; instead it consists of a continuous filamentary network, as shown in the SEM stereo micrographs. M.A.C.

N84-23453*# Hawaii Inst. of Geophysics, Honolulu. Planetary Geoscience Div.

RECENT COMET IMPACTS ON THE MOON: THE EVIDENCE FROM SPECTRAL REFLECTANCE STUDIES

B. R. Hawke and J. F. Bell *In* NASA. Washington Repts. of Planetary Geol. Program Apr. 1984 p 59-61 refs (For primary document see N84-23431 13-91)

Avail: NTIS HC A15/MF A01 CSCL 03B

The results of analyses of near infrared reflectance spectra are inconsistent with numerous previous interpretations of the Reiner Gamma Formation. These include: (1) nue ardente or volcanic ash deposits, (2) volcanically derived sublimates, (3) high albedo volcanic deposits, and (4) highlands debris emplaced as impact ejecta. These results, strongly suggest that the selective preservation of high albedo features (formed by secondaries) by a local magnetic field enhancement is not a viable hypothesis. The results are generally consistent with, but place constraints on, the cometary impact hypothesis of Schultz and co-workers. While the presence of a magnetized component was not detected in either the bright or dark portions of the Reiner Gamma Formation, this material may be present in amounts under the current detection limits. M.A.C.

N84-23454*# Geological Survey, Flagstaff, Ariz.

CHARACTERIZATION OF SURFICIAL GEOLOGIC UNITS ON VENUS FROM PIONEER VENUS RADAR DATA: A PROGRESS REPORT

P. A. Davis, G. G. Schaber, and H. Masursky *In* NASA. Washington Repts. of Planetary Geol. Program Apr. 1984 p 65-66 refs (For primary document see N84-23431 13-91)

Avail: NTIS HC A15/MF A01 CSCL 03B

A classification database using the reflectivity (derived from the altimetry data), rms slope, and the first principal component of altimetry and topographic slope is presented. The resultant clustered data is examined qualitatively as well as quantitatively, to establish the statistical integrity of each cluster by use of an interactive, ternary plotting algorithm. This algorithm plots, for a cluster, the position of each of its pixels within a ternary diagram whose apices represent reflectivity, rms slope, and the first principal component. The digital values in these three databases are normalized such that unity is represented by a value of 255 in each database. The frequencies of each plotted point within the ternary diagram are recorded in order to establish the mode of each cluster. The pixels of each cluster are displayed as one separate color; their ternary plot will show not only the interrelations between clusters, but also the presence of any anomalous points within a cluster. Existing lunar and terrestrial analog radar data is used to establish fields within this ternary diagram that are indicative of as many different geologic materials and tectonics settings as possible. The resultant fields are used to determine empirically the geologic significance of the clusters resulting from the cluster analysis. M.A.C.

N84-23455*# Arizona State Univ., Tempe. Dept. of Geology.

WIND ABRASION ON VENUS: A MEANS FOR EXPERIMENTAL INVESTIGATIONS

Ronald Greeley and John R. Marshall (Santa Clara Univ.) *In* NASA. Washington Repts. of Planetary Geol. Program Apr. 1984 p 67-68 (For primary document see N84-23431 13-91)

Avail: NTIS HC A15/MF A01 CSCL 03B

A study to determine the feasibility of conducting experiments to simulate the aeolian environment on Venus as related to wind abrasion was completed. Ideally, such experiments should involve complete investigation of weathering, in which mechanical, thermal, and chemical parameters are taken into account. This is particularly important for Venus, where atmospheric temperatures and pressures at the surface produce an environment which is equivalent to low or medium grade metamorphic conditions on Earth. Details that describe the Venus Aeolian Abrasion Device (VAAD) are included. The VAAD device would enable experiments to be conducted with the same chemistry, temperature, pressure, and other physical properties of the Venus atmosphere near the surface. The proposed device enables the important aeolian parameters to be controlled and monitored, including particle size, velocity, impact-angle and flux, atmospheric pressure, temperature, and gas composition. M.A.C.

N84-23456*# Arizona State Univ., Tempe. Center for Meteorite Studies.

AEOLIAN PROCESSES ON VENUS

Ronald Greeley *In* NASA. Washington Repts. of Planetary Geol. Program Apr. 1984 p 69-70 refs (For primary document see N84-23431 13-91)

Avail: NTIS HC A15/MF A01 CSCL 03B

Many of the questions regarding aeolian processes on Venus and the subsequent implications for surface history involve understanding the physics of particle motion in the venusian environment. The surface environment of Venus is simulated as closely as practicable using the Venus Wind Tunnel and to determine threshold wind speeds, particle flux, particle velocities, and the characteristics of various aeolian bedforms. Despite the relatively low wind speeds on Venus, the flux of windblown material on Venus is potentially high. A high fraction of material is

transported as surface creep by rolling, estimates yield rates up to 100 kg per cm lane width per year depending upon the availability of material and wind frequency, suggesting that the formation of lowland plains by aeolian processes and the burial of various landforms such as impact craters could occur on short geological time-scales. Wind tunnel simulations demonstrate that aeolian processes may be very effective in modifying the surface through erosion and deposited and may have an important influence on the composition of the atmosphere. M.A.C.

N84-23457*# Massachusetts Univ., Amherst. Dept. of Geology and Geography.
NEW MAPS OF LAKSHMI PLANUM AND EASTERN APHRODITE, VENUS
George E. McGill *In* NASA. Washington Repts. of Planetary Geol. Program Apr. 1984 p 71-73 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 03B

Interest on Venus has centered on three regions; (1) Aphrodite Terra, especially east of the main uplant portion, (2) Ishtar Terra, especially Lakshmi Planum and its bounding scarp and massifs, and (3) Beta Regio-Phoebe Regio. The last region is topographically similar to the East African rift system, and has been inferred to have a similar tectonic origin. The Aphrodite region is part of a 21,000 km long tectonic zone that seems best explained as due to extension, and that may represent hot spots clustered along an incipient divergent plate boundary. The most interesting and complex portion of this tectonic zone is that part of eastern Aphrodite between Thetis Regio and Atla Regio. In contrast, the Lakshmi Planum region has many topographic characteristics suggesting that it is a true continent, and thus indicative of convergence and a thick crust. Detailed topographic contour maps of eastern Aphrodite Terra and of Lakshmi Planum are included. M.A.C.

N84-23458*# California Univ., Los Angeles. Dept. of Earth and Space Sciences.
VENUS BANDED TERRAIN: EVALUATION OF TECTONIC MODELS FOR THE ORIGIN OF BANDING
Sean C. Solomon (MIT) and James W. Head (Brown Univ.) *In* NASA. Washington Repts. of Planetary Geol. Program Apr. 1984 p 74-75 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 03B

A tectonic orgin for Venus banded terrain is consistent with band spacing. Both compressional (folding) and extensional models for band formation can fit present observations. Band spacing cannot distinguish among scenarios for global heat loss and for the origin of highland terrain. Tectonic models for band formation indicate that the surface brittle layer in the venus highlands is no more than a few kilometers thick. M.A.C.

N84-23459*# Brown Univ., Providence, R. I. Dept. of Geological Sciences.
VENUS: THE NATURE OF THE SURFACE FROM VENERA PANORAMAS
J. B. Garvin, James W. Head, M. T. Zuber, and P. Helfenstein *In* NASA. Washington Repts. of Planetary Geol. Program Apr. 1984 p 76-78 (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 03B

Images of the surface of Venus obtained by the Soviet Venera 9, 10, 13 and 14 landers are analyzed to provide a basis for understanding the nature of geologic processes operating there. Bedrock is exposed at the Venera 10, 13 and 14 sites and is characterized by semi-continuous, flat polygonal to subrounded patches up to several meters in width. The bedrock surface is often dominated by sub horizontal to horizontal layered plates with thicknesses of several cm and abundant linear and polygonal vertical fractures. Soils (particles < 1 cm) are abundant at the Venera 9, 10 and 13 sites, but are uncommon at Venera 14. Features indicative of a strong aeolian influence (moats, dunes, wind tails) are not observed. Several hypotheses are considered for the origin of the bedrock surfaces, and it is concluded that bedrock originated from surface lava flows. The relative freshness of features observed by the Veneras suggests that erosion rates are very low or that some bedrock surfaces are geologically young. M.A.C.

N84-23460*# Brown Univ., Providence, R. I. Dept. of Geological Sciences.
GEOLOGY OF MAXWELL MONTES, VENUS
James W. Head, D. B. Campbell (Arecibo Observatory), A. R. Peterfreund, and S. A. Zisk (MIT) *In* NASA. Washington Repts. of Planetary Geol. Program Apr. 1984 p 79-80 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 03B

Maxwell Montes represent the most distinctive topography on the surface of Venus, rising some 11 km above mean planetary radius. The multiple data sets of the Pioneer missing and Earth based radar observations to characterize Maxwell Montes are analyzed. Maxwell Montes is a porkchop shaped feature located at the eastern end of Lakshmi Planum. The main massif trends about North 20 deg West for approximately 1000 km and the narrow handle extends several hundred km West South-West WSW from the north end of the main massif, descending down toward Lakshmi Planum. The main massif is rectilinear and approximately 500 km wide. The southern and northern edges of Maxwell Montes coincide with major topographic boundaries defining the edge of Ishtar Terra. M.A.C.

N84-23461*# Brown Univ., Providence, R. I. Dept. of Geological Sciences.
VENUS: GLOBAL DISTRIBUTION OF PIONEER-VENUS RADAR ROUGHNESS AND REFLECTIVITY AND GLOBAL CORRELATION OF ALTIMETRY, ROUGHNESS AND REFLECTIVITY OBSERVATIONS
James W. Head, J. B. Garvin, A. R. Peterfreund, S. A. Zisk (MIT), G. Pettengill (MIT), and V. S. Sharpton (Brown Univ.) *In* NASA. Washington Repts. of Planetary Geol. Program Apr. 1984 p 81-82 (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 03B

An improved version of the Pionner-Venus orbital data was used for a statistical analysis of global radar roughness and (alpha(0)) (rho) reflectivity. Classification maps of the venusian surface are produced in a supervised manner on the basis of statistical and empirical studies of the individual data sets. The primary objective is to assess the degree of homogeneity of surface radar properties within topographic provinces in order to map possible geologic boundaries. Maps were produced by correlating two data sets at a time. Classification of specific regions, such as Ishtar, has demonstrated that distinct geological units can be identified. M.A.C.

N84-23462*# Arizona Univ., Tucson. Lunar and Planetary Lab.
MARTIAN CRATER SIZE DISTRIBUTIONS AND TERRAIN AGE
Nadine G. Barlow and Robert G. Strom *In* NASA. Washington Rept. of Planetary Geol. Program, 1983 Apr. 1984 p 85-86 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 03B

The crater size/frequency distributions of large (> 8 km) craters on the Moon and terrestrial planets display two very different curves representing two crater populations. The heavily cratered regions of the Moon, Mercury, and Mars show the same highly structured curve which cannot be represented by a single slope distribution function. In contrast, the lunar post mare crater population has a size/frequency distribution which differs significantly from that in the highlands over the same diameter range, and can be represented by a single-slope distribution function of -2.8 differential. On areas of martian lightly cratered northern plains, the crater population is essentially identical to that of the post mare population. This indicates that the same two families of impacting objects were responsible for the cratering records on both Moon and Mars. The thickness of mantling material varies among the various plains units, and can be calculated from the depth/diameter scaling relations for martian craters. M.A.C.

N84-23463*# Geological Survey, Flagstaff, Ariz.
MERCURY: NEW IDENTIFICATION OF ANCIENT MULTI-RING BASINS AND IMPLICATIONS FOR GEOLOGIC EVOLUTION
Paul D. Spudis *In* NASA. Washington Rept. of Planetary Geol. Program, 1983 1984 p 87-89 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 03B

A systematic survey of the entire Mariner 10 coverage of Mercury was performed to determine the number, distribution and dimensions of additional ancient basins on the planet. Ancient multi-ringed basins on Mercury can be recognized by the following criteria: (1) arcs of massif chains and isolated massifs that protrude through younger units, (2) arcuate segments of lobate ridges (rupes) that align with massifs in circular patterns, (3) arcuate scarps that are aligned with ridges and massif, and (4) isolated regions of anomalously high topography within the intercrater regions of heavily cratered terrain. All of the newly identified basins predate the mercurian intercrater plains, previously held to be the oldest geologic unit on the planet. Subsequent structural evolution of various regions was influenced by the presence of these basins. Smooth plains units appear to be more extensive than mapped by Mariner [10] and more than 90 percent of them appear to be basin contained or basin related. The concentration of extensive smooth plains material within and associated with basin structural and depositional environments suggests a volcanic origin for most of this unit, analogous to the lunar maria. Basins appear to provide the basic structural pattern of early terrestrial planetary crusts.
M.A.C.

N84-23464*# Geological Survey, Menlo Park, Calif.
RING SPACING OF MERCURIAN MULTI-RING BASINS AND BASIN RING FORMATION
R. J. Pike and P. D. Spudis *In* NASA. Washington Rept. of the Planetary Geol. Program, 1983 1984 p 90-92 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 03B

Recent systematic mapping of Mercury has revealed many ancient and previously unrecognized multiring basins. The population of these basins now stands at 20, possibly is as large as 25, and includes at least 76 measurable rings. From the new data base, we present some systematics of basin ring spacing on Mercury, compare them with similar data for the Moon, and draw some preliminary conclusions on conditions of ring formation for basins on the terrestrial planets.
M.A.C.

N84-23465*# Geological Survey, Flagstaff, Ariz.
IMPACT OF UPHEAVAL DOME, UTAH **c46**
E. M. Shoemaker and K. E. Herkenhoff (California Inst. of Tech., Pasadena) *In* NASA. Washington Rept. of Planetary Geol. Program, 1983 Apr. 1984 p 93 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 08G

Reexamination of Upheaval Dome in the Canyonlands National Park, Utah, shows that the structure of this remarkable feature conforms with that expected for a deeply eroded astrobleme. The structure is definitely not compatible with an origin due simply to plastic flowage of salt and other rocks in the underlying Paradox Formation. The most strongly deformed rocks are bounded by a series of circumferential listric faults. The convergent displacement of the rocks corresponds to the deformation that results from collapse of a transient cavity produced by high speed impact. From considerations of the probable depth of exposure of the impact structure and upward extrapolation of the listric faults, the final collapsed crater is estimated to be about 8 to 10 km in diameter; the impacting body was on the order of 0.5 km in diameter.
Author

N84-23466*# Arizona State Univ., Tempe. Dept. of Geology.
MORPHOLOGY OF FRESH CRATERS ON GANYMEDE AND THE ORIGIN OF PEDESTAL CRATERS
Vicki M. Horner and Ronald Greeley *In* NASA. Washington Rept. of Planetary Geol. Program, 1983 Apr. 1984 p 94-96 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 03B

Properties of the planetary surface and subsurface can affect the morphology of impact craters. A mechanism was proposed to explain pedestal craters and domed floors within fresh craters on Ganymede. Voyager 1 and 2 images with resolutions = to or < 3.2 km/lp were examined and 523 fresh craters were identified. For each crater, the rim and ejecta diameters were measured, and the crater was characterized by ejecta class(es), interior features, floor morphology and target terrain. Of the craters examined, 97 show moderate to prominent doming of the crater floor; 340 craters have continuous ejecta which terminates in a scarp [pedestal craters], of which 86 (25%) have a high albedo diffuse deposit beyond the pedestal.
Author

N84-23467*# Planetary Science Inst., Tucson, Ariz.
DOES SATURATION CRATERING EXIST IN THE SOLAR SYSTEM?
William K. Hartmann *In* NASA. Washington Rept. of the Planetary Geol. Program, 1983 1984 p 97-99 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 03B

A number of researchers have concluded that saturation equilibrium cratering exists nowhere in the solar system, and therefore that diameter distributions in even the most heavily cratered provinces reveal initial production functions related to impacting bodies. Based on this premise, different populations of impactors are identified in different epochs and regions of the solar system. These hypotheses are clearly crucial to interpreting planetary history and need further independent examination. The production function in the outer solar system may differ from that in the inner solar system, but it is also possible that viscous relaxation of ice craters or immediate flooding of craters that penetrate through an ice lithosphere into watery substrate may explain the greater deficiency of large craters on icy moons. This problem is controversial and needs more study.
Author

N84-23468*# Massachusetts Inst. of Tech., Cambridge. Dept. of Geology and Geography.
DIFFERENTIAL DEGRADATION OF MARTIAN IMPACT BASINS
Marianne Stam *In* NASA. Washington Rept. of Planetary Geol. Program, 1983 1984 p 100-101 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 03B

Among the major problems of martian geologic history are the cause of the highland-lowland dichotomy, and of the scarp separating these two global-scale provinces. These features were formed after much of the early bombardment was completed; consequently, many of the surviving impact basins very likely were present during the creation of the dichotomy, and it is possible that differences in their present morphologies as a function of location and of relative age may provide clues to the tectonic and geomorphic processes responsible for the dichotomy and the scarp.
Author

N84-23469*# University of Northeast Louisiana, Monroe. Dept. of Geosciences.
PROGRESSIVE IMPACT CRATERING
R. A. DeHon *In* NASA. Washington Rept. of Planetary Geol. Program, 1983 1984 p 102-103 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 03B

Most cratering experiments are designed to study the effects of a single hypervelocity impact into a target of uniform properties. Experiments involving multiple impacts are usually limited to low velocity projectiles and unconsolidated target materials. Gault described saturation cratering in an unconsolidated target. Quaide and Oberbeck studied crater forms produced by hypervelocity impact into layered targets. Several investigators have modeled the generation of either a regolith or megaregolith by repeated impact on planetary surfaces. Studies now in progress examine changes in crater morphology and target properties by repeated impact into an initially consolidated target. Current studies employ

low velocity projectiles (2 g at 0.5 km/sec) and consolidated salt targets. Records of crater size, morphology, and accumulated ejecta thickness are maintained as impacts collect on the surface. Author

N84-23470*# Geological Survey, Menlo Park, Calif.
ODE TO GRAVITY: DEPTH/DIAMETER FOR FRESH CRATERS ON MERCURY
R. J. Pike and G. D. Clow *In* NASA. Washington Rept. of Planetary Geol. Program, 1983 1984 p 104-106 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 03B

Opinions conflict over the role of surface gravity in shaping impact craters on Mercury. One view holds that the effects of g are evident in measurable aspects of crater form; other investigators find little or no evidence for g's geomorphic importance. Ambiguity in the role of g and other variables in cratering on Mercury stems largely from uncertainty in identifying major geomorphic contrasts and the crater sizes at which they occur. One of these, depth/diameter (d/D), undergoes a major change at the transition from simple (bowl shaped) to complex (peaks and terraces) crater interiors. Four least-squares d/D fits for fresh craters on Mercury were attemped. The results are inconsistent. The d/D data that should resolve previous shortcomings is presented. The revised d/D distributions for simple and complex craters, which intersect at a diameter of about 5 km, support the initial thesis that g substantially influences the form of Mercury's craters. Author

N84-23471*# National Air and Space Museum, Washington, D.C. Center for Earth and Planetary Studies.
MORPHOLOGY OF BURIED CRATERS: LAVA THICKNESS ESTIMATES BY SIMULATED FLOODING
Ted A. Maxwell and Victoria F. Avery *In* NASA. Washington Rept. of Planetary Geol. Program, 1983 1984 p 107-109 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 03B

Partially and completely buried craters on planetary surfaces are used as probes to determine the thickness and extent of the overlying material as well as the composition of underlying terrain units. Rims of craters protruding through mare basalts on the Moon have been used extensively by DeHon (1977, 1979) to develop isopach maps of both the circular and irregular maria. Such estimates are possible because of Apollo topographic data and the extensive coverage by Lunar Orbiter photographs at various sun angles. On planetary surfaces without such data, however, shadow measurements can only be made by pixel listings with appropriate assumptions concerning support data. In addition, high resolution geochemical data is not available to determine whether the exposed crater rim is composed of material dissimilar from the lavas. Because of the need for lava thickness data, flooding of lunar mare and highland craters was simulated in order to determine empirical relationships between dimensions observed in orbital images and the thickness of the lava. B.W.

N84-23472*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE BOREALIS BASIN OF MARS
Don E. Wilhelms (Geological Survey, Menlo Park, Calif.) and Steven W. Squyres *In* NASA. Washington Rept. of Planetary Geol. Program, 1983 Apr. 1984 p 110-112 refs Sponsored in part by NASA and National Research Council (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 03B

Why the lowlands of Mars are concentrated in the Northern Hemisphere and the highlands in the Southern Hemisphere is probably the most fundamental unsolved problem in martian geology. No explanation that accounts both for this asymmetric distribution and for the isostatic equilibrium across the scarp or sloping transition zone dividing the two provinces has been generally accepted; thinning of the lithosphere in the northern hemisphere by internal processes has been suggested. Because other lowland-highland distributions on Mars, Moon, and Mercury are controlled by impact basins, it is proposed that a giant basin formed early in Mars' history has caused the martian hemispheric dichotomy as well. B.W.

N84-23473*# National Aeronautics and Space Administration, Washington, D. C.
CRATERING HISTORY OF THE SATURNIAN SATELLITES
J. B. Plescia (JPL, Pasadena) and J. M. Boyce *In its* Rept. of Planetary Geol. Program, 1983 1984 p 113-115 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 03B

In an attempt to relate the observed crater frequencies on the saturnian satellites with absolute time, the cratering history of the Saturn system was modeled. The model is based upon several assumptions. First, the cumulative flux history at Saturn resembles that of the inner solar system. That is to say, a high cratering rate which rapidly (exponentially) decayed over the first few hundred million years followed by a significatly lower but more constant flux to the present. Second, the end of the heavy bombardment occured about 3.7-3.8 b.y. ago. Third, Population I craters, dominated by large diameters and having a shallow size-frequency distribution slope, were formed during the period of heavy bombardment. Population II craters, characterized by small craters and a steep distribution slope, have formed since the heavy bombardment ended. B.W.

N84-23474*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
GEOMORPHIC CLUES TO THE MARTIAN VOLATILE INVENTORY. 1: FLOW EJECTA BLANKETS
David Pieri (DOE, Washington, D.C.), Stephen Baloga (Virginia Polytechnic Inst., Blacksburg), and Mary Norris *In* NASA. Washington Rept. of Planetary Geol. Program, 1983 1984 p 116-118 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A02/MF A01 CSCL 03B

There are classes of landforms whose presence on Mars is strongly suggestive, if not confirmatory, of the participation of volatiles, presumably water, in its geomorphic development: (1) valley networks, (2) outflow channels, (3) landslides, and (4) flow-ejecta blankets. The first two may represent landforms generated by the movement of volatiles from sources, while the latter two probably represent the dissipation of energy generated by forcing inputs (e.g., kinetic energy and gravity) modulated by volatiles. In many areas on Mars, all four processes have acted on the same lithologic materials and were influenced by the composition of those units, and possibility by the climatic regime at the time of their formation. One of the approaches discussed to this specific problem of landform genesis, and to the general problem of the present and past states of martian volatiles, is to attempt to constrain the distribution, amount, and history of available volatiles by using possible evidence of volatile participation expressed in the morphology of other related landforms (e.g., flow-ejecta blankets and landslides) coupled with physical models for landform genesis. B.W.

N84-23475*# State Univ. of New York, Buffalo. Dept. of Geological Sciences.
EAST BUTTE: A VOLCANIC DOME OF THE EASTERN SNAKE RIVER PLAIN, IDAHO c46
John E. Bretches and John S. King *In* NASA, Washington Rept. of Planetary Geol. Program, 1983 1984 p 121-124 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 08G

Preliminary mapping shows East Butte to be a single, large cumulo-dome composed dominantly of rhyolite which can be classified into three main groups based on color and structure. The rhyolite of East Butte is aphanitic with phenocrysts of sanidine and quartz which vary from 1 to 5 mm in length. Vesicular reddish black inclusions of basalt up to 10 cm in length, found in all varieties of the East Butte rhyolites are believed to have originated from fragmentation of the basalt walls of the conduit by rhyolitic magma as it was emplaced. Most of the inclusions contain plagioclase phenocrysts. These phenocrysts measure up to 1 to 2 cm in length and have a typical euhedral, tabular habit. A 250-m

diameter depression which has the appearance of a crater is located at the top of East Butte. Evidence supporting the fact that the depression is a crater is displayed by three small (3 to 5 m in height) mounds of massive rhyolite which border the depression. A.R.H.

N84-23476*# New Mexico Univ., Albuquerque. Dept. of Geology.
CHRONOLOGY, MORPHOLOGY AND STRATIGRAPHY OF PUMICEOUS PYROCLASTIC-FLOW (IGNIMBRITE) DEPOSITS FROM THE ERUPTION OF MOUNT ST. HELENS ON 18 MAY 1983 **c46**
C. William Criswell and Wolfgang E. Elston *In* NASA. Washington Rept. of Planetary Geol. Program, 1983 Apr. 1984 p 125-126 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 08G

Between 1217 and 1620 hours (PDT), on May 18, 1980, the magmatic eruption column of Mount St. Helens formed an ash fountain and pyroclastic flows dominated the eruption process over tephra ejection. Eurption-rate pulsations generally increased to a maximum at 1600 to 1700 hrs. After 1620 hrs, the eruption assumed an open-vent discharge with strong, vertical ejection of tephra. Relative eruption rates (relative mass flux rates) of the pyroclastic flows were determined by correlating sequential photographs and SLAR images, obtained during the eruption, with stratigraphy and surface morphology of the deposits. Author

N84-23477*# New Mexico Univ., Albuquerque. Dept. of Geology.
CLASSIFICATION OF VOLCANOES OF THE KANE PATERA QUADRANGLE OF IO: PROPORTIONS OF LAVA FLOWS AND PYROCLASTIC FLOWS **c46**
Wolfgang E. Elston *In* NASA, Washington Rept. of Planetary Geol. Program, 1983 Apr. 1984 p 127-129 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 08K

Voyager 1 images show 14 volcanic centers wholly or partly within the Kane Patera quadrangle of Io, which are divided into four major classes: (1) shield with parallel flows; (2) shield with early radial fan shapd flows; (3) shield with radial fan shaped flows, surfaces of flows textured with longitudinal ridges; and (4) depression surrounded by plateau-forming scarp-bounded, untextured deposits. The interpretation attempted here hinges largely on the ability to distinguish lava flows from pyroclastic flows by remote sensing. B.G.

N84-23478*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DISTRIBUTION AND PROPERTIES OF SMALL VOLCANOES IN ACIDALIA PLANITIA **c46**
Herbert Frey and Ann Semeniuk *In* NASA. Washington Rept. of Planetary Geol. Program, 1983 Apr. 1984 p 130-132 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 08K

Eastern Acidalia Planitia contains a wide variety of terrain types on which are thousands of subkilometer volcanoes. Apparent morphometric variations were previously reported as a function of terrain type for the cones in the Cydonia area and extended to the rest of Acidalia for which high resolution Viking imagery exist. Crater counts are included for the six types of plains identified, density distributions of subkilometer cones found on each type of terrain, and orphometric data by morphological subclass as a function of terrain for more than 1400 cones. Author

N84-23479*# Arizona State Univ., Tempe. Dept. of Geology.
THE 1950 SULFUR FLOW OF MAUNA LOA: CONSIDERATIONS FOR IO **c46**
Ronald Greeley, Ellene Theilig, and Philip Christensen *In* NASA. Washington Rept. of Planetary Geol. Program, 1983 Apr. 1984 p 133-134 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 08K

Some of the geological relationships observed in the Mauna Loa sulfur flow may apply in considering volcanic processes on Io. Given the presence of sulfur/sulfur compounds in the eruption plumes and on the surface of Io, it is likely that extensive secondary deposits of sulfur exist, some of which may be of fumarolic origin and analogous to the Mauna Loa deposit. Given the likelihood of silicate volcanism of Io based on the inferred material properties of some flows, and the attendant high temperatures for silicate volcanism, it is likely that the secondary surface deposits of sulfur would have been mobilized without being heated to the high viscosity stage. Mobilized sulfur flows on Io may flow long distances as a result of: (1) low viscosities in the melting range; (2) sustained effusion resulting from continued heating source area; (3) continued remobilization within the flow as a consequence of surges from the source; and (4) extension via lava tubes, or similar conduits through which there is little heat loss. Sulfur flows may form a relatively thin veneer over silicate flows and other surface units, given their fluidity and low mobilization temperature. Active splashing and splattering may spread sulfur over a wider area contributing the bright blooms observed in association with some Ionian flows. A.R.H.

N84-23480*# Geological Survey, Flagstaff, Ariz.
VOLCANISM IN THE VALLES MARINERIS **c46**
Baerbel K. Lucchitta *In* NASA. Washington Rept. of Planetary Geol. Program, 1983 Apr. 1984 p 135-137 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 08K

Tectoism in the Valles Marineris appears to have been accompanied by volcanism. The proposed volcanic features, though probably contemporaneous with the gigantic ones in the Tharsis area, are composed of small, mafic and, possibly, somewhat larger felsic flows. The size of these features is similar to that of volcanic flows on the Earth. A.R.H.

N84-23481*# Hawaii Univ., Honolulu. Planetary Geosciences Div.
VOLCANISM IN ELYSIUM PLANITIA, MARS
Peter J. Mouginis-Mark *In* NASA. Washington Rept. of Planetary Geol. Program, 1983 Apr. 1984 p 138-140 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 03B

Geomorphic mapping revealed that the three volcanic constructs within Elysium Planitia (Hecates Tholus, elysium Mons and Albor Tholus) are very different in their overall morphology and represent three distinct types of martian volcano. Hecates Tholus was found to possess the most likely possible example of a young, explosively generated, air fall deposit, while the volume of magma erupted from Elysium Mons appears to have been orders of magnitude larger than that erupted from Albor Tholus. A primary aim of the regional geological analysis of Elysium Planitia is to further understand the volcanic and tectonic evolution of the area by the identification and interpretation of individual lava flows and their source vents. Lava flow size, spatial distribution, flow direction and the stratigraphic relationships of these lava flows to adjacent structural features were all measured. The topographic form of Elysium Mons has totally controlled the flow direction of lava flows within Elysium Planitia. Lava flows from Elysium Mons can be traced for distances of 150 to 250 km in a radial direction from the volcano. Parasitic vents located beyond the recognizable volcanic construct also conform to this radial pattern. A second unusual characteristic of the Elysium Planitia region is the high frequency of occurrence of sinuous channels that are morphologically similar to lunar sinuous rilles. M.G.

N84-23482*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
EFFUSION RATE, LENGTH, AND AREA RELATIONSHIPS FOR SOME LAVA FLOWS ON HAWAII AND MOUNT ETNA WITH PLANETARY IMPLICATIONS **c46**
David Pieri and Stephen Baloga (DOE, Washington, D.C.) *In* NASA. Washington Rept. of Planetary Geol. Program, 1983 Apr. 1984 p 141-143 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 08K

A model for the radiative cooling of thermally well mixed lava

flows is presented and the relationship between effusion rate and length and area is analyzed. If radiative cooling is the prime mode of heat loss for a lava flow, one should expect to see a stronger correlation between the effusion rate and the plan area of the flow, than between effusion rate and just flow length. Different flows on a single volcano with differing initial temperatures, volatile content, and gross compositions should yield different areas for a given effusion rate. Likewise, a range of slopes for the relationship between effusion rate and flow area should result from comparisons between different volcanoes. As a test of these ideas, available data on the effusion rates, lengths, and areas of Hawaiian and Etnean flow is studied. It was found that: (1) the effusion rate/area correlation was statistically more significant than the correlation between effusion rate and length for four out of the five eruption episodes which met the necessary criteria of more than three individual flows with area, length, and effusion rate independently measured; (2) that there exists a minimum length and area for a given effusion rate, reflecting competition between overall characteristic proportionality between effusion rate and flow length, width, and area. M.G.

N84-23483*# Arizona State Univ., Tempe.
EXPERIMENTS ON WATER/MELT EXPLOSIONS, NATURE OF PRODUCTS, AND MODELS OF DISPERSAL **c46**
Michael F. Sheridan and Kenneth H. Wohletz (LASL) *In* NASA. Washington Rept. of Planetary Geol. Program, 1983 Apr. 1984 p 144-146 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 08G

Experiments were carried out in a steel pressure device using controlled amounts of water and thermite melt to examine the mechanical energy released on explosive mixing following the initial contact of the two materials. An experimental design was used to allow the direct calculation of the mechanical energy by the dynamic lift of the device as recorded both optically and physically. A large number of experiments were run to accurately determine the optimum mixture of water and melt for the conversion of thermal to mechanical energy. The maximum efficiency observed was about 12% at a water/thermite mass ratio of 0.50. These experiments are the basis for the development of models of hydroexplosions and melt fragmentation. Particles collected from the experimental products are similar in size and shape to pyroclasts produced by much larger hydrovolcanic explosions. Melt rupture at optimum ratios produces very fine particles whereas rupture at high or low water/melt ratios produces large melt fragments. Grain surface textures in the experimental products are also related to the water/melt ratio and the mechanism of explosive mixing. It is thus possible to have qualitative information about the nature of the explosion from the sizes and shapes of the fragments produced. M.G.

N84-23484*# Arizona State Univ., Tempe. Dept. of Geology.
RIDGES ON BASALT FLOWS **c46**
Eilene Theilig *In* NASA. Washington Rept. of Planetary Geol. Program, 1983 Apr. 1984 p 147-148 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 08G

Pressure ridges are surface features on basaltic lava flows and, as with other surface features, they may be related to the emplacement of a flow and the rheological properties of the lava. Since many ridges are of sufficient size to be detected on high resolution orbital images, an understanding of pressure ridges could provide a means for interpreting volcanic flows on other terrestrial planets. Some proposed formation mechanisms are reviewed and three different types of pressure ridges are identified on the basis of morphology. Type 1 ridges are the most common and are associated with multiple flow unit pahoehoe in which the ridges are embayed by secondary toe fed lava. They tend to be restricted to wider sections or margins of the flow and to be oriented longitudinal to flow direction; however, oblique or transverse orientation is not uncommon. Bulbous squeeze ups are common within cracks and may reflect relative timing of crack formation. The interior structure of type 1 ridges consists of an upper slab section which generally contains columnar joints and a lower massive section with an irregular surface. This basic distinction may mark the thickness of the surface crust when ridge formation was initiated. Type 2 ridges occur in association with type 1 and are very similar with the exception of the secondary squeeze out material. Instead of only filling cracks, the secondary material on these ridges originated from underneath a thin crust and flowed as toes or channels from the top and sides of the ridge. Type 3 ridges have much steeper sides (almost vertical at the top) than the other types. Medial cracks are very wide and the crack walls are convex upward. No squeeze ups are present. The main difference between type 3 and the others may be reflection of viscosity. M.G.

N84-23485*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
CALERAS IN THE SOLAR SYSTEM
C. A. Wood *In* NASA. Washington Rept. of Planetary Geol. Program, 1983 Apr. 1984 p 149-151 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 03B

Caldera-topped volcanoes are the largest volcanic edifices on a planet, and represent relatively long term development of near surface magma chambers. The types, geometries, numbers, and distributions of calderas on the Earth, Mars, Venus, and Io are compared. M.G.

N84-23486*# Cornell Univ., Ithaca, N.Y.
WIND STREAKS ON MARS: COMPARISONS OF PRODUCTION MODELS WITH OBSERVATIONS OF BRIGHT STREAKS
Steven W. Lee *In* NASA. Washington Rept. of Planetary Geol. Program, 1983 Apr. 1984 p 155-157 refs (For primary document see N84-23431 13-91)
(Grant NsG-7546)
Avail: NTIS HC A15/MF A01 CSCL 03B

To investigate the influence of crater size on martian wind streaks, the characteristics of bright streaks associated with craters ranging from approximately 100 m to 80 km in diameter were analyzed in several regions. The ratio of streak length to obstacle height (L/h) could be diagnostic of the relative effectiveness of different sized obstacles in disturbing near surface atmospheric flow; since the crater rim height to diameter relationship has not previously been determined for Mars, the rim heights of numerous craters were estimated from shadow measurements. In all areas studied, bright streak L/h values decrease with increasing h, indicating that smaller obstacles produce longer streaks relative to their height than do larger obstacles. Several models of bright streak production are used to explain this behavior are discussed. M.G.

N84-23487*# Geological Survey, Menlo Park, Calif.
MARTIAN DUST STORMS WITNESSED BY VIKING LANDER 1
Henry J. Moore and R. E. Arvidson Guinness (Washington Univ., St. Louis, Mo.) *In* NASA. Washington Rept. of Planetary Geol. Program, 1983 Apr. 1984 p 158-159 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 03B

Viking Lander 1 observations on Mars were punctuated by a strong local dust storm after two martian years of mild wind conditions. Tens of micrometers of dust settled to the surface during global dust storms of the first two falls and winters; some of this dust was locally removed during the second year. A late winter local dust storm of the first year caused little or no erosion of the surface materials despite wind speeds of 25 to 30 m/s. The strong local dust storm occurred during late winter of the third martian year. Winds of this storm altered and demolished small conical piles of surface materials constructed at the onset the first winter, removed 4 to 5 mm size fragments, displaced centimeter size fragments, destroyed clouds in areas disrupted by the sampler and footpad, eroded impact pits, and darkened the sky. Movement of erosional products and tiny wind tails indicate easterly to northeasterly winds. If the 4 to 5 mm size fragments were entrained and removd by the wind, threshold friction speeds near 3 to 5 m/s would have been required for the atmospheric

temperatures and pressures that prevailed during the late winter of the third year. M.G.

N84-23488*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
LONG RANGE TRANSPORT OF FINE GRAINED SEDIMENTS ON MARS: ATMOSPHERIC DUST LOADING, AS INFERRED FROM VIKING LANDER IMAGING DATA
James B. Pollack and David S. Colburn *In* NASA. Washington Rept. of Planetary Geol. Program, 1983 Apr. 1984 p 160 (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 03B

During the first Viking year, two global dust storms occurred and they contributed about 90% of the dust suspended in the Martian atmosphere on a global average, over the course of this year. The remainder was due to the cumulative effect of local dust storms. When globally distributed, the amount of suspended dust introduced into the atmosphere this Martian year was about 5x10(-3) g/sq cm. This mass loading was derived from the incremental optical depths measured over this year and estimates of the mean size of the dust particles (2.5 microns). During the second Martian year, global dust storms were far more muted than during the first year. No near perihelion dust storm occurred, and a somewhat weaker dust storm may have occurred near the start of the spring season in the Southern Hemisphere, at about the same time that the first global dust storm of the first year occurred. Thus, the dust loading derived for the first Martian year may be somewhat higher than the average over many Martian years, a conclusion that appears to be supported by preliminary studies of Martian years beyond the second Viking year on Mars. M.G.

N84-23489*# Cornell Univ., Ithaca, N.Y. Lab. for Planetary Studies.
DUST STREAKS ON MARS: COLORS AND PHOTOMETRY
P. Thomas *In* NASA. Washington Rept. of Planetary Geol. Program, 1983 Apr. 1984 p 161-162 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 03B

Photometric studies of crater related bright and dark streaks have strongly supported the hypothesis that the bright streaks are excess dust deposits and dark streaks are erosional windows in a partial dust cover. Red-blue (and red-violet) plots show that bright streaks are consistent with mosaics of bright red dust and background material. Here the plains are also consistent with a partial dust cover; the dark streak is the least covered area. Bright and dark streaks both reverse contrast relative to surrounding plains at phase angles over 100 deg in violet filter images. The similar phase behavior of both bright and dark streaks supports the idea that they are both changes in the amount of dust cover. Red-violet plots of bright streaks are most easily explained by mosaics of optically thick dust and plains material. Lengths of bright streaks are independent of their contrasts. This suggests the streak deposition, if in the mosaic patterns indicated above, is a function of available sites of deposition, rather than atmospheric dust loading. Contrasts of dark streaks with plains indicate the plains have fractional dust covers nealy as great as the maximum additional cover in bright streaks. The bright streaks thus store little of the global supply of dust. M.G.

N84-23490*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A POSSIBLE SOURCE FOR THE MARTIAN CIRCUMPOLAR DUNE MATERIAL
R. Stephen Saunders, Bruce Banerdt, Steve Sutton (Michigan Univ.), Frazer P. Fanale (Hawaii Univ.), Eric Laue, and Eric Stephens *In* NASA. Washington Rept. of Planetary Geol. Programs Apr. 1984 p 163-165 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 03B

The properties of freeze dried dilute dispersions of dust in water are of considerable interest in studies of sedimentary processes in the polar regions of Mars. The formation of a rind residue due to the sublimation of water ice containing various amounts of clay may be an important step in these processes. Such phenomena may occur as the result of seasonal or long term (climatic) sublimation of dirty ice caps on Mars. The development and disruption of dust residues on the surface of ice dust mixtures as a result of preferential ice sublimation were simulated in the laboratory. The characteristics of the resulting particles are described and a scenario for the formation of a Martian circumpolar dune field is suggested. M.G.

N84-23491*# Arizona State Univ., Tempe. Dept. of Geology.
VELOCITIES OF WINDBLOWN PARTICLES IN SALTATION: VENUS, EARTH, AND MARS
Ronald Greeley *In* NASA. Washington Rept. of Planetary Geol. Programs Apr. 1984 p 166-168 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 03B

Particle velocities were determined in environmental wind tunnels capable of simulating aeolian processes on Earth, Mars, and Venus. Comparisons of results for Earth, Mars, and Venus reveal some remarkable differences. Most particles achieve speeds nearly equal to freestream wind speed on Venus, but seldom achieve half the wind speed on Mars; Earth cases are of intermediate values. This is attributed to the differences in atmospheric density and to the threshold wind speeds among the three planetary environments. Particles are more easily moved in the dense venusian atmosphere than on Mars; consequently, threshold speeds are very low, and for the range of wind speeds in which most movement is presumed to occur (just above threshold speeds), the grains need not be moving very fast to achieve 100% of the wind speed. Conversely, particles on Mars must accelerate very rapidly to achieve the speed of the high winds required for threshold, and despite the fact that saltation path lengths are long on Mars, most grains fall to the surface before achieving even 50 to 60% of freestream wind speed. M.G.

N84-23492*# Arizona State Univ., Tempe. Dept. of Geology.
DESERT PAVEMENT STUDY AT AMBOY, CALIFORNIA c46
Steven Williams and Ronald Greeley *In* NASA. Washington Rept. of Planetary Geol. Programs Apr. 1984 p 169-170 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 08G

Desert pavement is a general term describing a surface that typically consists of a thin layer of cm-sized rock fragments set on top of a layer of finer material in which no fragments are found. An understanding of desert pavement is important to planetary geology because they may play a major role in the formation and visibility of various aeolian features such as wind streaks, which are important on Mars and may be important on Venus. A field study was conducted in Amboy, California to determine the formation mechanism of desert pavements. The probable sequence of events for the formation and evolution of a typical desert pavement surface, based on this experiment and the work of others, is as follows. Starting with a layer of surface material consisting of both fine particles and rock fragments, aeolian deflation will rapidly erode the surface until an armored lag is developed, after which aeolian processes become less important. The concentration of fragments then slowly increases as new fragments are brought to the surface from the subsurface and as fragments move downslope by sheet wash. Sheet wash would be responsible for removing very fine particles from the surface and for moving the fragments relative to one another, forming interlocks. M.G.

N84-23493*# Michigan Univ., Flint. Dept. of Research and Community Science.
WIND EROSION AND DUNE FORMATION ON HIGH FROZEN BLUFFS Abstract Only c46
W. M. Marsh and B. D. Marsh, (Johns Hopkins Univ., Baltimore) *In* NASA. Washington Rept. of Planetary Geol. Programs Apr. 1984 p 171 (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 08G

Frost penetration increases upslope on barren, windswept bluffs

in cold environments. Along the south shore of Lake Superior, near the brow of 100 m high bluffs it typically exceeds 5 m. Frost increases the shear strength of damp sand to a level comparable to that of concrete, making winter slopes highly stable despite undercutting by waves and ground-water sapping along the footslope. Sublimation of interparticle ice in the slope face increases with wind speed and lower vapor pressures. The cold and dry winter winds of Lake Superior ablate these slopes through loss of binding ice. Wind erosion rates, based on measurements of sand accumulation on the forest floor downwind of the brow, show most airborne sand falls out within several meters of the brow, forming a berm 1 to 3 m high after many years. The spatial pattern of sand deposition, however, varies considerably over distances of several hundred meters along the top bluffs in response to frost conditions and the build-up of gravel lag on the slope face, sand exposure from mass movements, and local aerodynamics of the crest slope. The formation of perched sand dunes in the Great Lakes region is clearly related to wind erosion of sand from high bluffs in winter. Broadly similar processes may operate on Mars. M.G.

N84-23494*# Arizona Univ., Tucson. Dept. of Geosciences.
FLUVIAL EROSION OF IMPACT CRATERS: EARTH AND MARS **c46**
Victor R. Baker *In* NASA. Washington Rept. of Planetary Geol. Programs Apr. 1984 p 175-177 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 08G

Geomorphic studies of impact structures in central Australia are being used to understand the complexities of fluvial dissection in the heavily cratered terrains of Mars. At Henbury, Northern Territory, approximately 12 small meteorite craters have interacted with a semiarid drainage system. The detailed mapping of the geologic and structural features at Henbury allowed this study to concentrate on degradational landforms. The breaching of crater rims by gullies was facilitated by the northward movement of sheetwash along an extensive pediment surface extending from the Bacon Range. South-facing crater rims have been preferentially breached because gullies on those sides were able to tap the largest amounts of runoff. At crater 6 a probable rim-gully system has captured the headward reaches of a pre-impact stream channel. The interactive history of impacts and drainage development is critical to understanding the relationships in the heavily cratered uplands of Mars. Whereas Henbury craters are younger than 4700 yrs. B.P., the Gosses Bluff structure formed about 130 million years ago. The bluff is essentially an etched central peak composed of resistant sandstone units. Fluvial erosion of this structure is also discussed. M.G.

N84-23495*# Geological Survey, Vancouver, Wash.
THE 19 MARCH 1982 ERUPTION AND LAHAR AT MOUNT SAINT HELENS: IMPLICATIONS FOR MARTIAN OUTLFOW CHANNELS? Abstract Only **c46**
Gary L. Beach *In* NASA. Washington Rept. of Planetary Geol. Programs Apr. 1984 p 178 (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 08K

A small explosive eruption of Mount St. Helens set into motion an unusually complex series of geomorphic and hydrologic processes that had not previously been described in the literature. This event was unusual in that a laterally-directed eruption dislodged and mobilized a thick snowpack from the surrounding crater floor and walls, resulting in the formation of a temporary lake. Catastrophic release of this self-impounded lake spawned a series of destructive debris avalanches and debris flows that moved rapidly down the volcano's north flank and into the North Toutle River valley. Catastrophic release of volatiles mobilized by volcanic activity has been discussed as a possible mechanism to explain a class of outflow channels on Mars. The eruption of Mount St. Helens provides a unique opportunity to study the deposits and landforms created by such an event; a more detailed field study and examination of Viking photographs of martian outflow channels is underway. M.G.

N84-23496*# Geological Survey, Vancouver, Wash.
DRAINAGE EVOLUTION IN THE DEBRIS AVALANCHE DEPOSITS NEAR MOUNT SAINT HELENS, WASHINGTON **c46**
Gary L. Beach and Dan Dzurisin *In* NASA. Washington Rept. of Planetary Geol. Programs Apr. 1984 p 179-181 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 08K

The 18 May 1980 eruption of Mount St. Helens was initiated by a massive rockslide-debris avalanche which completely transformed the upper 25 km of the North Fork Toutle River valley. The debris was generated by one of the largest gravitational mass movements ever recorded on Earth. Moving at an average velocity of 35 m/s, the debris avalanche buried approximately 60 sq km of terrain to an average depth of 45 m with unconsolidated, poorly sorted volcaniclastic material, all within a period of 10 minutes. Where exposed and unaltered by subsequent lahars and pyroclastic flows, the new terrain surface was characterized predominantly by hummocks, closed depressions, and the absence of an identifiable channel network. Following emplacement of the debris avalanche, a complex interrelationship of fluvial and mass wasting processes immediately began operating to return the impacted area to an equilibrium status through the removal of material (potential energy) and re-establishment of graded conditions. In an attempt to chronicle the morphologic evolution of this unique environmental setting, a systematic series of interpretative maps of several selected areas was produced. These maps, which document the rate and character of active geomorphic processes, are discussed. M.G.

N84-23497*# Rhode Island Univ., Kingston. Dept. of Geology.
FLUVIAL DRAINAGE SYSTEMS: MARGARITIFER SINUS AND AGYRE (NC, NE) QUADRANGLES, MARS
Jon C. Boothroyd and John A. Grant *In* NASA. Washington Rept. of Planetary Geol. Programs Apr. 1984 p 182-184 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 03B

Fluvial drainage systems, delineated by mapping on stereo pairs of Viking Orbiter images, have developed in various-sized basins in the Margaritifer Sinus (MC-19) and Agyre (MC-26) Quadrangles, Mars. The Ladon Valles system is the largest, draining into and through two multi-ringed impact basins. Smaller fluvial basins to the southeast of the Ladon structural basin appear to have internal drainage. An intermediate-scale fluvial basin containing Himera Vallis extends along a north-south axis at 22 W and opens northward toward outflow channels south of Margaritifer Chaos. Stereo-pair mapping was extended further to the east, in MC-19 Ne, Se, and MC-26 NE, to investigate sources of outflow to the Ares Vallis system. The direction of flow in the channel at the northeast quadrant of the Ladon Basin is unresolved at present because of the poor quality of images available to form stereo pairs. However, an easterly drainage basin boundary running north-south along longitude 9 W, and extending westward at latitude 32-35 S, encloses a series of longitudinal drainage systems. Both the Parana Valles-Loire Vallis system and the Samara Valles system appear to drain in a northwesterly direction. The Samara flows to the Himera drainage basin, and the Parana-Loire to the northeast Ladon channel area. M.G.

N84-23498*# Geological Survey, Menlo Park, Calif.
FREEZING OF MARTIAN STREAMS UNDER CLIMATIC CONDITIONS
Michael H. Carr *In* NASA. Washington Rept. of Planetary Geol. Programs Apr. 1984 p 185-187 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 03B

The valley networks of Mars are widely believed to have formed at a time when climatic conditions on the planet were significantly different from those that currently prevail. This view arises from the following observations: (1) the valleys form integrated branching networks which suggests fluid drainage, and water is the most plausible fluid, (2) the present atmosphere contains only minute amounts of water, (3) the networks appear to be more akin to terrestrial valleys that are eroded by streams of modest discharges

than features that form by catastrophic floods, and (4) small streams of water will rapidly freeze under present climatic conditions. Climatic conditions at the time of formation of the valleys are studied based on the assumption that they were cut by running water. R.J.F.

N84-23499*# Geological Survey, Flagstaff, Ariz.
DARK STREAKS ON TALUS SLOPES, MARS
H. M. Ferguson and B. K. Lucchitta *In* NASA. Washington Rept. of Planetary Geol. Programs Apr. 1984 p 188-190 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 03B

High-resolution pictures of talus slopes on Mars show small, dark streaks that characteristically widen downward. These streaks are different from the thin and even streaks of various albedos that stream from cliffs on talus slopes, but gradations between the two streak types occur and not all streaks can be classified with confidence. In order to study the nature and origin of the small, widening, dark streaks, all Viking pictures with a resolution of less than 100 m/pixel were surveyed. To date several hundred streaks were located, but only few are of high enough resolution to be confidently identified as widening downwards. The approximate dimensions of the streaks were measured and their shapes, numbers, position, and spacing on slopes were noted. They were plotted on a topographic map, and their relation to topography, geologic units, and regions of distinct thermal inertia and albedo were studied. Also noted was the season at which images containing streaks were acquired and the direction of illumination. Albedo measurements are in progress. Several streaks can be seen stereoscopically, but none are observed on color images. The observation of small dark streaks on talus slopes on Mars is compatible with an interpretation of their origin as eruptions of small masses of wet debris in places where steep walls intersect aquifers or where seasonal equatorial warming permits the local melting of ground ice. R.J.F.

N84-23500*# Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
QUANTITATIVE AND EXPERIMENTAL MODELLING OF SAPPING NETWORKS c46
Alan D. Howard and Craig Kochel *In* NASA. Washington Rept. of Planetary Geol. Programs Apr. 1984 p 191-193 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 08H

Development of drainage networks by erosion by emergent groundwater (sapping) is being modelled by a combination of laboratory experiments and theoretical modelling. Miniature drainage networks formed in fine-grained sediments share many morphologic characteristics of Martian and terrestrial networks suspected to be formed by sapping processes. A larger and better instrumented sapping box was constructed to further explore the processes of sapping and the morphology of resulting networks. The experiments to be conducted in the sapping box will investigate the roles of several factors in controlling network morphology. The mechanics of sapping of fine-grained sediments were investigated in experiments in a two-dimensional sapping chamber and through development of a theoretical model. Results of extensive tests on sapping erosion of fine-grained, cohesionless sediment were analyzed with a theoretical model of the mechanics of sapping erosion and transport. R.J.F.

N84-23501*# Arizona State Univ., Tempe. Dept. of Geology.
PLANETARY GEOMORPHOLOGY FIELD STUDIES: WASHINGTON AND ALASKA c46
Michael C. Malin *In* NASA. Washington Rept. of Planetary Geol. Programs Apr. 1984 p 194-195 ref (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 08G

Field studies of terrestrial landforms and the processes that shape them provide new directions to the study of planetary features. Investigations discussed address principally mudflow phenomena and drainage development. At the Valley of 10,000 Smokes (Katmai, AK) and Mount St. Helens, WA, studies of the development of erosional landforms (in particular, drainage) on fresh, new surfaces permitted analysis of the result of competition between geomorphic processes. Of specific interest is the development of stream pattern as a function of the competition between perennial seepage overland flow (from glacial or groundwater sources), ephemeral overland flow (from pluvial or seasonal melt sources), and ephemeral/perennial groundwater sapping, as a function of time since initial resurfacing, material properties, and seasonal/annual environmental conditions. R.J.F.

N84-23502*# New Mexico Univ., Albuquerque. Dept. of Geology.
A REGRESSION MODEL FOR THE TEMPORAL DEVELOPMENT OF SOIL PIPES AND ASSOCIATED GULLIES IN THE ALLUVIAL-FILL VALLEY OF THE RIO PUERCO, CENTRAL NEW MEXICO c46
Christopher D. Condit and Wolfgang E. Elston *In* NASA. Washington Rept. of Planetary Geol. Programs Apr. 1984 p 196-197 (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 08H

On Mars, the association of gullied escarpments and chaotic terrain is evidence for failure and scarp retreat of poorly consolidated materials. Some martian gullies have no surface outlets and may have drained through subterranean channels. Similar features, though on a much smaller scale, can be seen in alluvium along terrestrial river banks in semiarid regions, such as the Rio Puerco Valley of central New Mexico. Many of the escarpments along the Rio Puerco are developing through formation of collapse gullies, which drain through soil pipes. Gully development can be monitored on aerial photographs taken in 1935, 1962, and 1980. A regression model was developed to quantify gully evolution over a known time span. Soil pipes and their associated collapse gullies make recognizable signatures on the air photos. The areal extent of this signature can be normalized to the scarp length of each pipe-gully system, which makes comparisons between systems possible. R.J.F.

N84-23503*# Oregon State Univ., Corvallis. School of Oceanography.
EXPERIMENTS EXAMINING THE SHAPES OF ISOLATED BARS IN COMPARISON WITH THOSE OCCURRING IN BRAIDED RIVERS c43
Paul D. Komar *In* NASA. Washington Rept. of Planetary Geol. Programs Apr. 1984 p 198-199 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 08H

Sand bars and islands within braided rivers have characteristic rhomboid or diamond shapes, often becoming very complex in form as the density of islands increases. Similar forms are observed in the martian outflow channels where the islands occur in groups. This contrasts with the more isolated martian islands which have airfoil shapes, as do isolated streamlined islands in rivers and in the Channeled Scabland. These observations indicate that the bar and island forms are controlled by the density of the islands, with increasing island interaction and flow modification as the density increases. As a continuation of previous flume experiments on the shapes of isolated islands, a new series of experiments investigate the modifications produced by a progressive increase in island density, finally leading to a true braided system. R.J.F.

N84-23504*# Oregon State Univ., Corvallis. School of Oceanography.
THE EROSION OF STREAMLINED ISLANDS, LONGITUDINAL GROOVES AND SCOUR MARKS: IMPLICATIONS TO THE ORIGIN OF THE MARTIAN OUTFLOW CHANNELS c43
Paul D. Komar *In* NASA. Washington Rept. of Planetary Geol. Programs Apr. 1984 p 200-202 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 08H

The diversity of proposed origins for large Martian outflow channels results from the differing interpretations given to the landforms associated with the outflow channels. In an attempt to help limit the possible mechanisms of channel erosion, detailed

studies of three of the channel features were done; the streamlined islands, longitudinal grooves and scour marks. This examination involved a comparison of the martian streamlined islands with various streamlined landforms on Earth including those found in the Channel Scabland in large rivers, glacial drumlins, and desert yardangs. The comparisons included statistical analyses of the landform lengths versus widths and positions of maximum width, and an examination of the degree of shape agreement with the geometric lemniscate which was in turn demonstrated to correspond closely with true airfoil shapes. The analyses showed that the shapes of the martian islands correspond closely to the streamlined islands in rivers and the Channel Scabland land. Drumlins show a much smaller correlation. Erosional rock islands formed by glaciers are very much different in shape. R.J.F.

N84-23505*# Geological Survey, Flagstaff, Ariz.
SMALL-SCALE POLYGONS ON MARS
Baerbel K. Lucchitta *In* NASA. Washington Rept. of Planetary Geol. Programs Apr. 1984 p 205-208 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 03B

Polygonal-fracture patterns on the martian surface were discovered on Viking Orbiter images. The polygons are 2-20 km in diameter, much larger than those of known patterned ground on Earth. New observations show, however, that polygons exist on Mars that have diameters similar to those of ice-wedge polygons on Earth (generally a few meters to more than 100 m). Various explanations for the origin of these crustal features are examined; seasonal desiccation and thermal-contraction cracking in ice-rich ground. It is difficult to ascertain whether the polygons are forming today or are relics from the past. The crispness of some crack suggests a recent origin. On the other hand the absence of upturned edges (indicating actively forming ice wedges), the locally disintegrating ground, and a few possible superposed rayed craters indicate that the polygons are not forming at the present. R.J.F.

N84-23506*# Louisiana State Univ., Baton Rouge. Dept. of Geology.
PERMAFROST ON MARS: DISTRIBUTION, FORMATION, AND GEOLOGICAL ROLE
Dag Nummedal *In* NASA. Washington Rept. of Planetary Geol. Programs Apr. 1984 p 209-211 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 03B

The morphology of channels, valleys, chaotic and fretted terrains and many smaller features on Mars is consistent with the hypothesis that localized deterioration of thick layers of ice-rich permafrost was a dominant geologic process on the Martian surface. Such ground ice deterioration gave rise to large-scale mass movement, including sliding, slumping and sediment gravity flowage, perhaps also catastropic floods. In contrast to Earth, such mass movement processes on Mars lack effective competition from erosion by surface runoff. Therefore, Martian features due to mass movement grew to reach immense size without being greatly modified by secondary erosional processes. The Viking Mission to Mars in 1976 provided adequate measurements of the relevant physical parameters to constrain models for Martian permafrost. R.J.F.

N84-23507*# Whittier Coll., Calif. Dept. of Geology.
GLACIAL AND PERIGLACIAL LANDFORMS IN DENMARK: SCANDINAVIAN ANALOGS FOR MARTIAN FEATURES
Lisa A. Rossbacher *In* NASA. Washington Rept. of Planetary Geol. Programs Apr. 1984 p 212-214 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 03B

The geomorphology of Denmark is dominated by glacial deposits, including both end moraines and ground moraines. Many of these features have morphologies similar to features observed on Mars. A characteristic landscape complex in Denmark is a series of irregular mounds or parallel curvilinear ridges that outline the former ice margin. Many of these resemble curviliner features on Mars, and the Danish landforms occur at a similar scale. Another distinctive landform in Denmark is the hummocky moraine landscape found in parts of Sjaelland. Although their size is smaller, these areas resemble the hummocky terrain associated with some of the curvilinear features in the northern plains of Mars. The hummocky Danish terrain is probably caused by the melting of masses of dead ice left during glacial retreat. Similar landscapes observed developing during retreat of smaller glaciers were ice caps in Scandinavian mountains and in Greenland. R.J.F.

N84-23508*# Whittier Coll., Calif. Dept. of Geology.
CURVILINEAR GROUND ON MARS: THE SEARCH FOR TERRESTRIAL ANALOGS Abstract Only
Lisa A. Rossbacher *In* NASA. Washington Repts. of Planetary Geol. Program Apr. 1984 p 215 (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 03B

Curvilinear features on Mars have dimensions ranging from 0.5 to 18.6 km in length and 0.2 to 2.0 km in width; these landforms can occur as curving ridges and troughs, rimless arcuate depressions, or features with no apparent relief. The Martian curvilinear ground has a relatively consistent relationship to both regional and local geomorphology. These landforms are one of a suite of features that occur near the base of the regional slope that marks the transition from the cratered uplands to the northern plains. Based on morphologic similarities, numerous terrestrial analogs were proposed for these Martian features. These include gilgai, backwasting scarps, solifluction lobes, ice-cored ridges and glacial moraines. Process models for the origin of the curvilinear ground suggest that its formation probably involved several processes, including scarp retreat by backwasting. R.J.F.

N84-23509*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
WEATHERED STONY METEORITES FROM VICTORIA LAND, ANTARCTICA, AS POSSIBLE GUIDES TO ROCK WEATHERING ON MARS
J. L. Gooding *In* NASA. Washington Repts. of Planetary Geol. Program Apr. 1984 p 216-218 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 03B

Parallel studies of Martian geomorphic features and their analogs on Earth continue to be fruitful in deciphering the geologic history of Mars. In the context of rock weathering, the Earth-analog approach is admirably served by the study of meteorites recovered from ice sheets in Antarctica. The weathering environment of Victoria Land possesses several Mars-like attributes. Four of the five Antarctic meteorites being studied contain rust and EET-A79005 further possesses a conspicuous, dark, weathering rind on one side. Secondary minerals (rust and salts) occur both on the surfaces and interiors of some of the samples and textural evidence indicates that such secondary mineralization contributed to physical weathering (by salt riving) of the rocks. Several different rust morphologies occur and emphasis is being placed on identifying the phase compositions of the various rust occurrances. A thorough understanding of terrestrial weathering features of the meteorites is a prerequisite for identifying possible Martian weathering features (if such features exist) that might be postulated to occur in some meteorites. R.J.F.

N84-23510*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SALTS IN THE DRY VALLEYS OF ANTARTICA c46
E. K. Gibson, Jr., B. J. Presley (Texas A&M Univ.), and J. Hatfield (Utah State Univ.) *In* NASA. Washington Repts. of Planetary Geol. Program Apr. 1984 p 219-221 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 08G

The Dry Valleys of Antarctica are examples of polar deserts which are rare geological features on the Earth. Such deserts typically have high salinities associated with their closed-basin waters and on many surficial materials throughout them. In order to examine the possible sources for the salts observed in association with the soils in the Dry Valleys. The chloride and

bromide concentrations of the water leachates from 58 soils and core samples were measured. The Cl/Br ratio for seawater is 289 and ratios measured for most of the 58 soils studied (greater than 85% of the soils studied) was larger than the seawater ratio (ratios typically were greater than 1000 and ranged up to 50,000). The enrichment in Cl relative to Br is strong evidence that the alts present within the soils were derived from seawater during ordinary evaporation processes, and not from the deposition of Cl and Br from aerosols or from rock weathering as has often been suggested. R.J.F.

N84-23511*# Geological Survey, Flagstaff, Ariz.
MULTIPROCESS EVOLUTION OF LANDFORMS IN THE KHARGA REGION, EGYPT: APPLICATIONS TO MARS c43
C. S. Breed, J. F. McCauley, and M. J. Grolier *In* NASA. Washington Rept. of Planetary Geology Program, 1983 Apr. 1984 p 225-227 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 08B

In order to understand better the polygenetic evolution of landforms on the martian surface, field studies were conducted in and around the Kharga Depression, Egypt. The Kharga region, on the eastern edge of Egypt's Western Desert, was subject to erosion under mostly hyperarid climatic conditions, punctuated by brief pluvial episodes of lesser aridity, since early Pleistocene time. The region contains numerous landforms analogous to features on the martian surface: yardangs carved in layered surficial deposits and in bedrock, invasive dune trains, wind-modified channels and interfluves, and depressions bounded by steep scarps. Like many of the topographic depresions on Mars, the Kharga Depression was invaded by crescentic dunes. In Egypt, stratigraphic relations between dunes, yardangs, mass-wasting debris, and wind-eroded flash-flood deposits record shifts in the relative effectiveness of wind, water, and mass-wasting processes as a function of climate change. R.J.F.

N84-23512*# University of Northeast Louisiana, Monroe.
INVERSION OF TOPOGRAPHY IN MARTIAN HIGHLANDS TERRAINS
R. A. DeHon *In* NASA. Washington Rept. of Planetary Geology Program, 1983 Apr. 1984 p 228-229 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 03B

One unique feature on Mars is the presence of ring furrows which are apparently produced by inversion of topography at the rims of partially buried craters. Ring furrows are flat-floored trenches, circular in plan view, forming rings 7 to 50 km in diameter. The moat is on the order of 0.5 km deep and 2 to 10 km wide, and it surrounds a flat topped circular mesa or plateau that is 5 to 40 km across. The central plateau is at the same elevation or lower than the surrounding plain outside the ring. The circular nature and size range of ring furrows tend to suggest that these features are related to craters partially buried by younger lava flows. The rings have been formed by preferential removal of the exposed crater rims. Ground ice decay, sapping, or fluvial erosion removed the less resistant, porous material of crater rims while leaving the more resistant volcanic flow material. Differential erosion has thus led to a reversal of topography in which the original positive relief of the rim is reduced to a negative relief feature. R.J.F.

N84-23513*# Arizona Univ., Tucson. Dept. of Geosciences.
THE CORFU LANDSLIDE: ANALOG TO GIANT LANDSLIDES ON MARS Abstract Only
Scott W. Lewis and Victor R. Baker *In* NASA. Washington Rept. of Planetary Geology Program, 1983 Apr. 1984 p 230 (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 03B

In an analog to the great landslides of the Vales Marineris, Mars, a detailed study was made of the Corfu Landslide in south-central Washington. This prehistoric slide is located on the northern flank of the Saddle Mountains, southwest of Othello, Washington. The slide covers a 13 square km area centered on section 11 of T.15N., R.27E., Willamette Meridian, adjacent to the Corfu townsite. Approximately 1 cubic km of material is involved in sliding that was probably initiated by Missoula flooding through the Channeled Scabland. It is concluded that there were four primary factors involved in the initiation of the Corfu landsliding: (1) A slip surface was present at the right orientation; (2) Glacial flooding undercut the slope; (3) Wetter climatic conditions prevailed during that time period; and (4) Some seismic vibrations, known to occur locally, probably acted as a trigger. These factors show that special conditions were required in conjunction to produce landsliding. Studies in progress of the Vales Marieneris suggest that the same factors probably contributed to landsliding there. R.J.F.

N84-23514*# Arizona State Univ., Tempe. Dept. of Geology.
PLANETARY GEOMORPHOLOGY FIELD STUDIES: ICELAND AND ANTARCTICA c46
Michael C. Malin *In* NASA. Washington Rept. of Planetary Geology Program, 1983 Apr. 1984 p 231-233 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 08G

Field studies of terrestrial landforms and the processes that shape them provide new directions to the study of planetary features. These studies, conducted in Iceland and in Antarctica, investigated physical and chemical weathering mechanisms and rates, eolitan processes, mudflow phenomena, drainage development, and catastrophic fluvial and volcanic phenomena. Continuing investigations in Iceland fall in three main catagories: (1) catastrophic floods of the Jokulsa a Fjollum, (2) lahars associated with explosive volcanic eruptions of Askja caldera, and (3) rates of eolian abrasion in cold, volcanic deserts. The ice-free valleys of Antarctica, in particular those in South Victoria Land, have much is common with the surface of Mars. In addition to providing independent support for the application of the Iceland findings to consideration of the martian erosional system, the Antarctic observations also provide analogies to other martian phenomena. For example, a family of sand dunes in Victoria Valley are stabilized by the incorporation of snow as beds. R.J.F.

N84-23515*# Wesleyan Univ., Middletown, Conn. Dept. of Earth and Environmental Sciences.
SCARP DEVELOPMENT IN THE VALLES MARINERIS
P. C. Patton *In* NASA. Washington Rept. of Planetary Geology Program, 1983 Apr. 1984 p 234-236 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 03B

The scarps along the margins of the Vales Marineris display a complex assemblage of forms that have been related to a variety of mass wasting and sapping processes. These scarp segments display variations in the degree of development of spur and gully topography, the number and density of apparent sapping features and the frequency of large scale landslides which reflect the age, geology and processes of slope development throughout the Valles Marineris. This regional analysis should provide more information on the geologic evolution of the Valles Marineris as well as new insight into the relative importance of different processes in the development of the scarp forms. In order to evaluate the regional variation in scarp form and the influence of time and structure on scarp development geomorphic mapping and morphometric analysis of geologically distinct regions of Valles Marineris is being undertaken. R.J.F.

N84-23516*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
GEOMORPHIC CLUES TO THE MARTIAN VOLATILE INVENTORY: LANDSLIDES
David Pieri and Ann Kirkpatrick *In* NASA. Washington Rept. of Planetary Geology Program, 1983 Apr. 1984 p 237-239 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 03B

Eight landslide locales were selected in Valles Marineris for preliminary geomorphological mapping. Four main suites of morphological features were identified. In four order outward from

the head scarp they are: (1) large ridges in head area, transverse to movement direction, probably slump blocks or pieces of wall that fell or toppled, possibly backward rotated; (2) smaller ridges, convex toward distal edge of slides, many with lobate pattern, some possibly step like scarps rather than ridges; (3) thin, sheet like debris cover, forms discrete fan shaped lobe with edge scarps unconfined; and (4) low transverse, continuous ridges (possibly folds) found at distal edge of slides, where debris appears to have encountered obstructions (e.g., opposing canyon walls), but not all confined slides exhibit this feature. Any one landslide can possess all or some of these features. Slides in the western Valles Marineris are more complex and show more variety than those in the eastern part. A.R.H.

N84-23517*# Whittier Coll., Calif. Dept. of Geology.
TEMPORAL AND SPATIAL DISTRIBUTION OF EXHUMED TOPOGRAPHY **c46**
Dallas D. Rhodes *In* NASA. Washington Rept. of Planetary Geology Program, 1983 Apr. 1984 p 240-242 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 08G

Perhaps the greatest chance for exhumation, or burial, of a landscape by terrestrial processes exists near the boundaries of the climatic belts. In the Southern Hemisphere, there is comparatively little land area within Budel's zone of extra-tropical valley formation, which contains most of the examples of exhumed topography in the Northern Hemisphere. The only examples of resurrected landforms that occur within Budel's tropical zone are located near the boundary of this zone, where climate may have changed during the Pleistocene. The ages of exhumed landforms sampled are not equally distributed through geologic time. Most of the exhumed features were created either during the Precambrian or the Tertiary periods which are commonly cited as episodes of significant landform development. A.R.H.

N84-23518*# Arizona Univ., Tucson. Lunar and Planetary Lab.
A TECTONIC GEOMORPHOLOGICAL CLASSIFICATION OF THE WALLS OF VALLES MARINERIS
John R. Spencer *In* NASA. Washington Rept. of Planetary Geology Program, 1983 Apr. 1984 p 243-245 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 03B

Viking 1 imagery of the Coprates NW quadrangle was used in an attempt to develop a geomorphic classification scheme for the canyon walls of Valles Marineris analogous to that devised to evaluate the relative tectonic activity of terrestrial mountain fronts. The four classes of walls established are described and mapped. Regions where a class cannot be assigned owing to the presence of intra canyon sediments, landslides, or landslide debris; and apparent fault scarps that occur on the canyon floor rather than at the wall base are also shown. The most striking feature is the concentration of active tectonic features within Ius Chasma, and to a lesser extent in Tithonium Chasma, as well as along the north walls of Coprates and East Candor. A.R.H.

N84-23519*# Hawaii Univ., Honolulu. Planetary Geosciences Div.
SURFACE COMPOSITIONS IN THE ARISTARCHUS REGION: IMPLICATIONS FOR REGIONAL STRATIGRAPHY
H. R. Hawke, P. G. Lucey, T. B. McCord, C. M. Pieters (Brown Univ., Providence, R.I.), and J. W. Head (Brown Univ., Providence, R.I.) *In* NASA. Washington Rept. of Planetary Geology Program, 1983 Apr. 1984 p 250-252 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 03B

Near infrared reflectance spectra for the Aristachus region, obtained using the 2.2m UH telescope at the Mauna Kea Observatory, were reduced and analyzed. The spectra obtained for the central peak, southern floor, southwestern wall, eastern wall, and northwestern wall of Aristachus crater exhibit shallow continuum slopes, relatively strong feldspar bands, pyroxene bands stronger than those typically seen in the spectra of fresh higland features, and pyroxene band centers near I micrometer suggesting the dominance of Ca rich clinopyroxene. The spectrum of the south rim of Aristachus is quite distinct from those of other crater units. The position of Aristrchus on the plateau/mare boundary raises questions concerning compositional variations in crater ejects deposits. A.R.H.

N84-23520*# Massachusetts Univ., Amherst. Remote Sensing Center-Hasbrouck.
A CASE FOR OLIVINE ON MARS
R. Huguenin, L. Vale, and D. McIntire *In* NASA. Washington Rept. of Planetary Geology Program, 1983 Apr. 1984 p 253-258 refs (For primary document see N84-23431 13-91)
(Grants NsG-7405; NAGw-440)
Avail: NTIS HC A15/MF A01 CSCL 03B

Results are reported which support earlier proposals that olivine may be an important phase on Mars. The analysis is based on the similarity of the laboratory reflectance spectrum of ALHA 77005, a meteorite proposed to be from Mars, and the telescopic spectrum of a dark area north of Hellas on Mars (15 S, 300 W). The Mars spectrum is shown as well as a continuum spectrum that, when divided into the Mars spectrum, reveals the absorption feature produced by the surface rocks and soil. A.R.H.

N84-23521*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
GALILEAN SATELLITE MULTISPECTRAL DATA BASE PRODUCTION
T. V. Johnson, J. A. Mosher, and L. A. Soderblom (Geological Survey, Flagstaff, Ariz.) *In* NASA. Washington Rept. of Planetary Geology Program, 1983 Apr. 1984 p 259-260 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 03B

A photometrically and geometrically reduced data base is being produced for the Galilean Satellites using Voyager imaging data. The basic data set used is essentially all the useful satellite images returned by Voyager. Each frame was radiometrically calibrated and many are projected into cartographic formats. Mosaics of low, medium and high resolution frames being made for each satellite consist of registered digital images with intensity values scaled through a traceable calibration procedure to normal albedo values. Many of the mosaics are being made in two versions. One version is an albedo version and the second is a maximum discrimination version in which large variations in brightness across the picture are suppressed. A.R.H.

N84-23522*# Geological Survey, Flagstaff, Ariz.
MULTI-IMAGE PHOTOMETRIC SOLUTIONS FOR THE GALILEAN SATELLITES
Alfred S. McEwan and Laurence A. Soderblom *In* NASA. Washington Rept. of Planetary Geology Program, 1983 Apr. 1984 p 261-262 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 03B

A method for determining the limb darkening planet, acquired in the same wavelength range (lambda), within a few degrees of the same phase angle (alpha), but acquired at different illumination and viewing conditions. The two images are first geometrically registered in simple cylindrical format. A limb darkening factor is computed for each pixel pair and output as a digital image. Systematic trends with photometric coordinates across this image indicate either a calibration error or inappropriateness of the particular photometric function. This method can be used for any photometric function with a single limb darkening factor, such as the Minnaert function or the function which combines the Lommel-Seeliger and Lambert functions. By solving for many pairs of images, the limb darkening factor as a function of alpha and lambda may be determined. The two image limb darkening solutions determined for 1 Voyager image pair on Ganymede, 16 image pairs on Callisto, 44 pairs on Europa, and 19 pairs on Io are discussed. A.R.H.

N84-23523*# Geological Survey, Flagstaff, Ariz.
RAPID EXTRACTION OF RELATIVE TOPOGRAPHY FROM VIKING ORBITER IMAGES. 2: APPLICATION TO IRREGULAR

TOPOGRAPHIC FEATURES

P. A. Davis and L. A. Soderblom *In* NASA. Washington Rept. of Planetary Geology Program, 1983 Apr. 1984 p 263-265 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 03B

The ratio and flat field photoclinometric methods for determining crater form topography are described. Both methods compensate for the effects of atmospheric scattering by subtracting a haze value from all brightness values. Algorithms were altered to derive relative topographic data for irregular features such as ejecta blankets, lava flows, graben and ridge scarps, dune forms, and stratified materials. After the elevations along the profiles are obtained by integration of the photometric function, a matrix transformation is applied to the image coordinates of each pixel within each profile, utilizing each pixel's integral height, to produce a projection of each profile line onto the surface. Pixel brightness values are then resampled along the projected track of each profile to determine a more correct height value for each pixel. Precision of the methods is discussed. A.R.H.

N84-23524*# Arizona State Univ., Tempe. Dept. of Geology.
THERMAL INFRARED ANALYSIS OF VOLCANIC SURFACES: MARS AND HAWAII

James R. Zimbelman *In* NASA. Washington Rept. of Planetary Geology Program, 1983 Apr. 1984 p 266-267 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 03B

High spatial resolution data from the Viking infrared thermal mapper (IRTM) are used to examine the Tharsis volcanoes which are situated within a vast area of low thermal inertia material very fine particle size or very high porosity, with the volcanoes having the lowest thermal inertias. Thermal infrared images of the 1823 flow on Kilauea's southwest rift zone show lower thermal inertias near the vent area where shelly pahoehoe is common while individual channelized aa flows with abundant broken pahoehoe slabs are higher thermal inertia. The increase in aa flows to the southeast leads to a general trend of increasing thermal inertias from near vent to distal areas. Martian shield volcanoes have thermal inertias equal to or higher than their surrounding plains when atmospheric effects are removed from the data. The general increase in thermal inertias away from the summit calderas is consistent with the trend of the Hawaiian 1823 flow and may be related to changing lava properties away from the summit. A.R.H.

N84-23525*# Geological Survey, Flagstaff, Ariz.
RADAR BACKSCATTER MODELLING Progress Report. c32

Gerald G. Schaber, Richard C. Kozak, and Robert L. Gurule *In* NASA. Washington Rept. of Planetary Geology Program, 1983 Apr. 1984 p 268-269 ref (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 17I

The terrain analysis software package was restructured and documentation was added. A program was written to test Johnson Space Center's four band scatterometer data for spurious signals data. A catalog of terrain roughness statistics and calibrated four frequency multipolarization scatterometer data is being published to support the maintenance of Death Valley as a radar backscatter calibration test site for all future airborne and spacecraft missions. Test pits were dug through sand covered terrains in the Eastern Sahara to define the depth and character of subsurface interfaces responsible for either backscatter or specular response in SIR-A imagery. Blocky sandstone bedrock surfaces at about 1 m depth were responsible for the brightest SIR-A returns. Irregular very dense CaCO3 cemented sand interfaces were responsible for intermediate grey tones. Ancient river valleys had the weakest response. Reexamination of SEASAT l-band imagery of U.S. deserts continues. A.R.H.

N84-23526*# Arizona State Univ., Tempe. Dept. of Geology.
PINACATE-GRAN DESIERTO REGION, MEXICO: SIR-A DATA ANALYSIS c43

P. Christensen, R. Greeley, J. McHone, Y. Asmerom, and S. Barnett *In* NASA. Washington Rept. of Planetary Geology Program, 1983 Apr. 1984 p 270 (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 08B

Radar images (SIR-A) from the Columbia space shuttle were used to assess the radar returns of terrain shaped by volcanic, aeolian, and fluvial processes in northwest Sonora. Field studies and photointerpretation show that sand dunes are poorly imaged by SIR-A, in contrast to SEASAT, evidently a consequence of the greater SIR-A incidence angle; star dunes are visible only as small bright spots representing merging arms at dune apices which may act as corner reflectors. Desert grasses and bushes (approx. 2 m high) have little effect on radar brightness. Only larger trees with woody trunks approx. 0.5 m across are effective radar reflectors; their presence contributes to radar bright zones along some arroyos. The radar brightness of lava flows decreases with surface roughness and presence of mantling windblown sediments and weathering products; however, old uplifted (faulted) flows are of equal brightness to fresh, unmantled aa flows. Maar craters display circular patterns of varying radar brightness which represent a combination of geometry, slope, and distribution of surface materials. Some radar bright rings in the Pinacates resemble craters on radar but are observed to be playas encircled by trees. A.R.H.

N84-23527*# Arizona State Univ., Tempe. Dept. of Geology.
RADAR-VISIBLE WIND STREAKS IN THE ALTIPLANO OF BOLIVIA c43

Ronald Greeley and Philip Christensen *In* NASA. Washington Rept. of Planetary Geology Program, 1983 Apr. 1984 p 271-272 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 08B

Isolated knobs that are erosional remnants of central volcanoes or of folded rocks occur in several areas of the Altiplano are visible on both optical and images. The optically visible streaks occur in the immediate lee of the knobs, whereas the radar visible streaks occur in the zone downwind between the knobs. Aerial reconnaissance and field studies showed that the optically visible streaks consist of a series of small (< 100 m wide) barchan and barchanoid dunes, intradune sand sheets, and sand hummocks (large shrub coppice dunes) up to 15 m across and 5 m high. On LANDSAT images these features are poorly resolved but combine to form a bright streak. On the radar image, this area also appears brighter than the zone of the radar dark streak; evidently, the dunes and hummocks serve as radar reflectors. The radar dark streak consists of a relatively flat, smooth sand sheet which lacks organized aerolian bedforms, other than occasional ripples. Wind velocity profiles show a greater U value in the optically bright streak zone than in the radar dark streak. A.R.H.

N84-23528*# Stanford Univ., Calif. Center for Radar Astronomy.
THE CASE FOR AEOLIAN CONTROL OF METER-SCALE SURFACE TEXTURE ON MARS

Richard A. Simpson and G. Leonard Tyler *In* NASA. Washington Rept. of Planetary Geology Program, 1983 Apr. 1984 p 273-275 (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 03B

The origin of Mars surface units and the extent of subsequent cratering play key roles in determining surface texture. At scale sizes of 0.1-10 meters, however, there is a growing body of evidence that wind is the dominant force. The direct and indirect evidence which implies that meter-scale surface texture on Mars is controlled by the wind is presented. Since radar is uniquely sensitive to structure on these scales, radio wave scattering data can provide insight on aeolian activity available from no other source. A.R.H.

N84-23529*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
IS THERE RADAR EVIDENCE FOR LIQUID WATER ON MARS?

L. E. Roth *In* NASA. Washington Rept. of Planetary Geology Program, 1983 Apr. 1984 p 276-278 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 03B

The hypothesis that an extraordinary radar smoothness of a lunar target suggests that ground moisture is rest on the assumption that on the penetration-depth scale, the dielectric constant be an isotropic quantity. In other words, the planet's surface should have no vertical structure. Results of modeling exercises (based on the early lunar two-layer models) conducted to simulate the behavior of radar reflectivity, at S-band, over Solis Lacus, without manipulating the dielectric constant of the base layer (i.e., without adding moisture) are summarized. More sophisticated, explicit, rather than iterative multi-layer models involving dust, duricrust, mollisol, and permafrost are under study. It is anticipated that a paradoxical situation will be reached when each improvement in the model introduces additional ambiguities into the data interpretation. A.R.H.

N84-23530*# Hawaii Univ., Honolulu. Planetary Geosciences Div.

HYPSOMETRIC STUDIES OF MARS.

Pamela L. Blake, Peter J. Mouginis-Mark, and Stanley H. Zisk (NEROC Haystack Observatory, Westford, Mass.) *In* NASA. Washington Rept. of Planetary Geology Program, 1983 Apr. 1984 p 279-281 refs (For primary document see N84-23431 13-91)

Avail: NTIS HC A15/MF A01 CSCL 03B

Altitude data derived from the 12.6 cm radar measurements obtained at JPL's Goldstone Facility were used to explore the utility of this type of regional analysis and to develop criteria for the interpretation of hypsometric data for planets where no visual images are available. Examination of the radar-derived hypsogram for Mars shows that the unimodal distribution of elevations contains several second order peaks and is skewed toward a modal elevation of about 3.5 km above the 6.1 mb datum. Individual topographic features can be recognized from this hypsogram, but such interpretations are based on the known surface morphology that has been determined from spacecraft images. It is not yet known how, for example, cratered terrain, regional slopes or other morphological features could be identified using the hypsogram if no images were available for ground-truth. The role that large impact craters play in influencing the shape of a hypsogram is being studied. A.R.H.

N84-23531*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

CORRECTION AND GEOLOGICAL ANALYSIS OF LUNAR 3.8 CM RADAR DATA

P. E. Clark (Murray State Univ., Ky.) and T W. Thompson *In* NASA. Washington Rept. of Planetary Geology Program, 1983 Apr. 1984 p 282-283 refs (For primary document see N84-23431 13-91)

Avail: NTIS HC A15/MF A01 CSCL 03B

Several 3.8 cm radar frames were calibrated empirically by histogram fitting, because no instrument background data is available. Then data were corrected for geometric distortion by: (1) redetermining position of individual frames using most accurate recent lunar ephemerides; (2) reprojecting frames into simple cylindrical map projection; (3) using most recent catalog of lunar craters to determine the exact positions of features identifiable on radar frames; and (4) correcting for apparent distortion (misplacement of features in frames) by resampling using a different bilinear interpolation derived for each of the parallelopipeds of the set defined for each frame. A hardcopy set of corrected frames was produced. Attempts to produce a mosaic of such corrected frames continue. The resulting mosaic can be used to show the systematic relationship between photographic thermal IR and radar data at different wavelengths in a region dominated by both mare and highland terrain. A.R.H.

N84-23532*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

MAPPING AND GEOLOGICAL ANALYSIS OF MERCURY RADAR DATA

P. E. Clark (Murray State Univ., Ky.), M. E. Strobell (Geological Survey, Flagstaff, Ariz.), G. G. Schaber (Geological Survey, Flagstaff, Ariz.), R. F. Jurgens, and G. S. Downs *In* NASA. Washington Rept. of Planetary Geology Program, 1983 Apr. 1984 p 284-286 refs (For primary document see N84-23431 13-91)

Avail: NTIS HC A15/MF A01 CSCL 03B

Although many radar profiles and images of the area within 20 deg of Mercury's equator had been obtained from 1971 to 1981, at both Goldstone and Arecibo radar facilities, surprisingly little geological analysis had been done with these data until recently. Topographic profiles and radar roughness reflectivity images which can be derived from these data will be crucial in completing the geological mapping of Mercury now underway at the U.S. Geological Survey. Processing of available radar data must be completed to establish any systematic relationship between radar reflectivities and roughness, density, dielectric constant, and other related geological parameters. Specific tasks accomplished for these purposes include the following. Documentation was located and searched to establish the type and quantity of Goldstone 12.5 cm radar observations which were available for Mercury. Data has been collected during approximately 50 observation periods from 1971 to 1981. About half of the data, collected during 1972 and 1973, have been processed, but without adequate documentation. A standardized, well-documented procedure for processing and analysis for all Goldstone Earth-based observations of Mercury was established. B.W.

N84-23533*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

MERCURY: TOPOGRAPHIC AND GEOLOGIC DATA FROM EARTH-BASED RADAR OBSERVATIONS c46

M. E. Strobell (Geological Survey, Flagstaff, Ariz.), P. E. Clark (Murray State Univ., Ky.), G. G. Schaber (Geological Survey, Flagstaff, Ariz.), R. F. Jurgens, and G. S. Downs *In* NASA, Washington Rept. of Planetary Geology Program, 1983 Apr. 1984 p 287 refs (For primary document see N84-23431 13-91)

Avail: NTIS HC A15/MF A01 CSCL 08G

Significant new geologic information has been revealed by comparing 1:5 million scale geologic maps of the equatorial zone quadrangles of Mercury (H-6, H-7 and H-8) to Earth-based elevation profiles and surface reflectivity maps of Mercury obtained in the early 1970's at the Arecibo (PR) and Goldstone (CA) radar facilities. These data consist of 23 Goldstone images and profiles of polarized return data at 12.5-cm wavelength and one Arecibo profile. Radar data with 150-m vertical accuracy and 10- to 20-km horizontal resolution are available for areas between latitudes 13 N. and 11 S. In general, these data sets show excellent correlation between: (1) relative elevation and roughness differences that are reflected by mapped geologic contacts; (2) mapped ridges and scarps that display distinctive radar signatures; and (3) position and morphology of crater-and-basin topographic elements. Inferences can also be drawn about topographic and geologic terrain beyond the area imaged by Mariner 10 cameras. Author

N84-23534*# Massachusetts Inst. of Tech., Cambridge. Dept. of Earth and Planetary Sciences.

ELYSIUM REGION, MARS: CHARACTERIZATION OF TECTONIC FEATURES

J. Lynn Hall, Sean C. Solomon, James W. Head (Brown Univ., Providence, R. I.), and Peter J. Mouginis-Mark (Hawaii Univ., Honolulu) *In* NASA. Washington Rept. of Planetary Geology Program, 1983 Apr. 1984 p 291-292 refs (For primary document see N84-23431 13-91)

Avail: NTIS HC A15/MF A01 CSCL 03B

In this paper the tectonic features of the Elysium region are identified and characterized. Identification of features was made using USGS controlled photomosaics (Elysium quadrangle, and portions of Amenthes and Cebrenia quadrangles); Viking Orbiter photographic data were used in individual cases to assist in identification. The positions and orientations of tectonic features can then be used, in conjunction with estimates of the mass of the volcanic load obtained from gravity modelling, to constrain the thickness of the elastic lithosphere in the region. B.W.

N84-23535*# Geological Survey, Flagstaff, Ariz.
ANCIENT VOLCANO-TECTONIC STRUCTURES OF THE OLYMPUS MONS REGION, MARS
Elliot C. Morris *In* NASA. Washington Rept. of Planetary Geology Program, 1983 Apr. 1984 p 293-295 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 03B

Two old volcano-tectonic collapse structures are exposed north and northeast of the huge shield volcano, Olympus Mons. They are semicircular and were probably low shield volcanoes similar to Alba Patera, but whose central portions have subsided or collapsed. They form the basement upon which younger volcanic materials of Alba Patera Olympus Mons have been emplaced. The oldest structure, Acheron Fossae is over 700 km across and is north of Olympus Mons. It has a surface of considerable relief broken by graben and extensive en echelon and parallel fractures and faults with varied displacements. Acheron Fossae is the most densely cratered in the Olympus Mons region. The structure must have formed very early in martian time. The second is Halex Fossae, northeast of Olympus Mons. Where exposed, it is cut by a series of arcuate grabens that become closer spaced toward its center. The radii of the fractures indicate that the structure may be at least 250 km across and centered beneath the Olympus Plains. Lava flows appear to have issued from some of the arcuate fractures and to have flowed radially away from the center of Halex Fossae. North of Halex Fossae, material of the same age as Halex Fossae overlaps Acheron Fossae. B.W.

N84-23536*# Geological Survey, Flagstaff, Ariz.
MARS APLEOSTRATIGRAPHY
David H. Scott *In* NASA. Washington Rept. of Planetary Geology Program, 1983 Apr. 1984 p 296-297 ref (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 03B

The relative time of emplacement of some major rock units on Mars was recognized to some degree from geologic mapping using Mariner Images. Correlation charts showing the map units and their position in sequence, however, displayed little discrimination in their vertical range of occurrence. A more detailed time-stratigraphy is currently being developed as Viking geologic mapping of the planet progresses. B.W.

N84-23537*# Geological Survey, Flagstaff, Ariz.
VALLES MARINERIS LAYERED DEPOSITS: IMPLICATIONS OF ORIGIN
David H. Scott and Nanci E. Witbeck *In* NASA. Washington Rept. of Planetary Geology Program, 1983 Apr. 1984 p 298-300 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 03B

Layered deposits within Valles Marineris and its associated system of canyons have been considered to consist of two different rock types: (1) thick, competent, cliff-forming, light and dark bedded material in canyon walls, and (2) relatively thin, alternating series of light and dark layered material, both horizontal and inclined, that form rounded hills and large flat-topped mesas rising above the canyon floors. The dissimilarity in appearance between canyon wall and floor materials, as well as their contrasting patterns of erosion, have been considered strong evidence that their modes of origin were different. Author

N84-23538*# National Air and Space Museum, Washington, D.C.
COMPRESSIONAL FEATURES IN THE THARSIS REGION OF MARS: GEOGRAPHIC
Thomas R. Watters and Ted A. Maxwell *In* NASA. Washington Rept. of Planetary Geology Program, 1983 Apr. 1984 p 301-303 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 03B

Studies of the stratigraphy of southwest Coprates have led to further constraints on both the geographic extent and the relative age of the major compressional ridge forming events in the Tharsis region of Mars. Southwestern Coprates is characterized by curvilinear ridges that are regularly spaced, suggestive of harmonic folding. The western edge of the ridged plains unit of Coprates is marked by volcanic flow fronts. In an enhanced Viking-Orbiter image, a ridge can be seen completely surrounded by a flow with only a small portion of the ridge crest still exposed. Comparison of partially buried ridges on the western edge of the ridged plains to those in central Coprates suggests that flooding of the inter-ridge plains does not exceed a few hundred meters. The morphological relationship between the flow units to the west and the ridged plains indicates that the deformational events in this region predates the emplacement of the younger units. B.W.

N84-23539*# National Air and Space Museum, Washington, D.C.
COMPRESSIONAL FEATURES IN THE THARSIS REGION OF MARS: ORIENTATIONS AND TIMING OF DEFORMATION
Thomas R. Watters and Ted A. Maxwell *In* NASA. Washington Rept. of Planetary Geology Program, 1983 Apr. 1984 p 304-306 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 03B

The Tharsis ridge system appears to form a great circle around the major volcanoes. The roughly circumferential orientation of these ridges could be interpreted as the formation of a ridge system in response to a single stress field with a center near Pavonis Mons. Wise, et al. (1979) plotted the perpendiculars to strikes of ridges on the eastern flanks of Tharsis as great circles on the upper hemisphere of an equal area net. In order to further test for circular symmetry and possible other influences on ridge orientations, normals to vector means of ridge orientations were calculated using over 1850 digitized ridge segments sampled in 10 degree boxes. Orientations of individual ridge segments were weighted by their lengths, and the magnitudes of normals to vectors means were weighted by cummulative length of the ridge segments. Normals to vector means with magnitudes less than 100 km are not shown. Assuming a single fold origin for ridges, the resulting plot shows compressive stress trajectories for the ridges in the Tharsis region. The averaged compressive stress orientation around Tharsis confirm the suggestion by Wise, et al. that the ridge system is not concentric to any single point. B.W.

N84-23540*# Massachusetts Univ., Amherst. Dept. of Geology and Geography.
INTERPRETATION OF PLANETARY STRESS SYSTEMS: DETERMINATION OF TECTONIC OVER-PRINTING IN NORTHWEST WYOMING c46
Donald U. Wise and M. Lee Allison *In* NASA. Washington Rept. of Planetary Geology Program, 1983 Apr. 1984 p 307-309 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 08G

Structural and tectonic interpretations of planetary surfaces rely strongly on visual determination of regional structural grain. This grain can be very complex and confusing, and sorting out of discrete trends in time and space is of utmost importance. This study is a test of these techniques applied to a well known area having several discrete structural grains. In the Bighorn Basin region of Wyoming, a largely overlooked N10E structural grain has been verified with detailed structural analysis and indicates a significant change in stress orientation at the end of the Laramide orogeny. Author

N84-23541*# Geological Survey, Flagstaff, Ariz.
THE GALILEAN SATELLITE GEOLOGICAL MAPPING PROGRAM, 1983 Abstract Only
B. K. Lucchitta *In* NASA. Washington Rept. of Planetary Geology Program, 1983 Apr. 1984 p 313 (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 03B

The Galilean Satellite Geological Mapping Program was established to illuminate detailed geologic relations on the four large satellites of Jupiter. The program involves about 40 investigators from various universities, reseach institutes, and government offices in the United Sttes, England, Germany, and Italy. A total of 24 researchers have been assigned to map 10 quadrangles on Ganymede, 15 to map 6 quadrangles on Io, and 3 to map 2 quadrangles on Europa. All maps are at a scale of 1:5 million

except for three of the Io maps, where high-resolution pictures permitted compilation of selected areas at larger scales. Author

N84-23542*# University of Northern Arizona, Flagstaff. Dept. of Geology.
RELATIONSHIPS AND TECTONICS OF THE Jg-7 QUADRANGLE OF GANYMEDE
Marvin F. Glotfelty and Charles W. Barnes *In* NASA. Washington Rept. of Planetary Geology Program, 1983 Apr. 1984 p 314-316 refs (For primary document see N84-23431 13-91)
Avail: NTIS HC A15/MF A01 CSCL 03B

Craters within the Ganymede Jg-7 quadrangle were divided into seven mappable units. The units represent: (1) irregular or elongate craters, (2) craters with dark ejecta, (3) palimpsests, (4) secondary craters, (5) and craters of young, mature, and old age. Symbols used for crater floors include: (1) flat floors, (2) floors with pits, (3) floora with a central dome or peak, (4) and floors with a central dome and pit. Grooved terrains were divided into five mappable units. Three units of light grooved material represent small, medium, and large grooves, which are arbitrarily divided. The other two units of grooved terrain represent dark grooved materials, and reticulate grooves. Two units of ungrooved dark terrain and two units of ungrooved light terrain were defined. In Galileo Regio, two units were defined repesenting large furrowed grooves, and smaller grooves which are orthogonal to the furrowed grooves. B.W.

N84-23543*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
THE STUDY OF THE PHYSICS OF COMETARY NUCLEI Semiannual Progress Report, 1 Oct. - 31 Mar. 1984
Fred L. Whipple May 1984 62 p refs
(Grant NsG-7082)
(NASA-CR-173519; NAS 1.26:173519; SAPR-19) Avail: NTIS HC A04/MF A01 CSCL 03B

The observations of comet P/Holmes 1892III, exhibiting two 8 to 10 magnitude bursts, were carefully analyzed. The phenomena are consistent with the grazing encounter of a small satellite with the nucleus. The grazing encounter produced, besides the first great burst, an active area on the nucleus, which was rotating retrograde with a period of 16.3 hr and inclination nearly 180 deg. After the final encounter, the spin period was essentially unchanged, but two areas became active, separated some 164 deg in longitude on the nucleus. After the first burst the total magnitude fell less than two magnitudes, while the nuclear region remained diffuse or complex, rarely if ever showing a stellar appearance. The fading was much more rapid after the second burst (barely naked eye at maximum) while the nucleus frequently stellar after the first day. It seems reasonable to conclude that the grazing encounter distributed a volume of large chunks in the neighborhood of the nucleus, maintaining activity for weeks. S.L.

N84-23544*# Arizona Univ., Tucson. Dept. of Planetary Science.
GEOLOGIC INVESTIGATIONS OF OUTER PLANETS SATELLITES Final Report
Robert G. Strom [1984] 20 p refs
(Grant NAGw-135)
(NASA-CR-173497; NAS 1.26:173497) Avail: NTIS HC A02/MF A01 CSCL 03B

Four tests are examined: (1) investigation of volcanism on Io; Interim results of thermal and structural modeling of volcanism on Io are presented, (2) a study of the ancient heavily cratered regions on Ganymede, (3) a geologic comparison of the cratering record on Ganymede and Callisto, and (4) a geological and chemical investigation of internal resurfacing processes on the Saturnian satellites. Tasks 2, 3, and 4 utilize Voyager imaging data. M.A.C.

N84-23545*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
A SUMMARY OF WHISTLERS OBSERVED BY VOYAGER 1 AT JUPITER Progress Report
W. S. Kurth, B. D. Strayer, D. A. Gurnett, and F. L. Scarf 20 Dec. 1983 39 p Prepared in cooperation with TRW Space and Technology Group, Redondo Beach, CA
(Grant NAGw-337; Contract N00014-76-C-0016)
(NASA-CR-173415; NAS 1.26:173415; AD-A138377; UI-83-31)
Avail: NTIS HC A03/MF A01 CSCL 03B

We summarize the Voyager 1 observations of whistlers at Jupiter in order to provide a basis for further analyses of the density profile of the Io plasma torus as well as to support studies of atmospheric lightning at Jupiter. All the whistlers detected by Voyager 1 fell into three general regions in the torus at radial distances ranging between 5 and 6 R sub J. An analysis of the broadband wave amplitudes measured by the Voyager 1 plasma wave instrument and estimates of the peak whistler amplitudes imply the grouping of whistlers was due to variations in the sensitivity of the receiver to whistlers and not to variations in the source or propagation paths of the whistlers. The whistler dispersions are presented in statistical form for each of the three groups of events and analyzed in view of the structure of the Io plasma torus as determined by plasma probe measurements. The results of these analyses give source locations for the whistlers at the foot of the magnetic field lines threading the torus in both hemispheres and over a range of longitudes. Author (GRA)

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N84-23546 Michigan Univ., Ann Arbor.
MEASUREMENT AND ANALYSIS OF DIFFUSE SOLAR IRRADIANCE Ph.D. Thesis
Clifford Bruce Baker 1983 105 p
Avail: Univ. Microfilms Order No. DA8402235

Measurements of the diffuse irradiance on a horizontal surface using a continuous tracking occulting disc and a pyranometer have been examined for cloudless days. The part of the diffuse component that is blocked by the occulting disc (circumsolar component) is analyzed with respect to the aerosol optical depth at a wavelength of 500 nanometers, solar zenith angle, and precipitable water. The magnitude of the circumsolar component is determined from the direct normal irradiance measured with a pyrheliometer, aerosol optical depth and precipitable water measured with a Volz sun photometer, and direct normal irradiance calculated from a direct beam model. The model was used to estimate only the direct beam over the same spectral interval as measured by the pyrheliometer. The computed component is subtracted from the measured direct normal irradiance and multiplied by the cosine of the solar zenith angle. The difference is an approximate value of the circumsolar irradiance on a horizontal surface. It is found that the circumsolar irradiance is a maximum for a small solar zenith angles, low aerosol optical depths, and small amounts of precipitable water. Dissert. Abstr.

N84-23547 Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
PHYSICS AND CHEMISTRY IN THE PRIMITIVE SOLAR NEBULA
Gregor E. Morfill Sep. 1983 143 p refs Presented at Les Houches Summer School, Aug. 1983 Submitted for publication (MPE-Preprint-21; ISSN-0340-8922) Copyright. Avail: Issuing Activity

The physics and chemistry of the primitive solar nebula are explained as a collapsing protosolar cloud which evolves into a viscous accretion disk, surrounding and feeding the central protostar. Physical processes are discussed and the transport theory of small dust particles and trace vapors in a turbulent disk is developed. The cosmochemical consequences arising from this picture are compared with measurements in our solar system. It is concluded that the viscous accretion disk, which must be regarded as the protoplanetary cloud, provides a model which

gives very detailed quantifiable cosmochemical predictions, and that these predictions are in good agreement with available observations from meteorite studies. The model implies that planet formation and star formation are concurrent. Author (ESA)

N84-23548# Aerospace Corp., El Segundo, Calif. Space Sciences Lab.
ON THE RATE OF ENERGY INPUT IN THERMAL SOLAR FLARES
U. Feldman, G. A. Doschek, and D. L. McKenzie 7 Dec. 1983 19 p
(Contract F04701-83-C-0084)
(AD-A138345; TR-0084(4940-01)-1; SD-TR-83-81) Avail: NTIS HC A02/MF A01 CSCL 03/2

The rise phases of solar soft X-ray flares observed by X-ray crystal spectrometers on p78-1 are discussed in terms of the rate of change of X-ray flux as a function of time. It is shown that the flux increased exponentially over most of the rise time. The e-folding time TAU has a cut-off at 13 s. Soft X-ray flares with smaller values of TAU are not observed. It is suggested that this phenomenon is due to the ability of the solar atmosphere to absorb the input energy and convert it into a typical soft X-ray flare. For energy input rates that are below a certain critical value the temperature attained by the plasma is around 20,000,000 K, but for values above the critical value, the gas is heated to much higher temperatures T sub e > or = 10 to the 8th K, producing a certain class of hard X-ray events. Author (GRA)

93 SPACE RADIATION

Includes cosmic radiation; and inner and outer Earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N84-23549# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
STUDY OF VARIABILITY IN EXTRAGALACTIC RADIO SOURCES AT 22 GHz AND 44 GHz [ESTUDO DE VARIABILIDADES DE RADIOFONTES EXTRAGALATICAS EM 22 GHZ E 44 GHZ]
Luiz Claudio Lima Bott Oct. 1983 126 p refs In PORTUGUESE; ENGLISH summary
(INPE-2913-TDL/149) Avail: NTIS HC A07/MF A01

Observations were made of the quasars 3C 273 and OV 236, the radio galaxy Cen A and nonthermal radio source in the Galactic Center at 22 and 44 GHz, in order to study the short and long term variability of these objects. The radio sources Virgo A, G 298.2-0.3 and Jupiter were used as calibration sources. The observations were made during a period of two years and a half with the Itapetiga radio telescope. The radio sources Sgr A, OV 236 and 3C 273 have shown long period variability in 22 GHz. Short period variability was also detected at both 22 and 44 GHz. B.W.

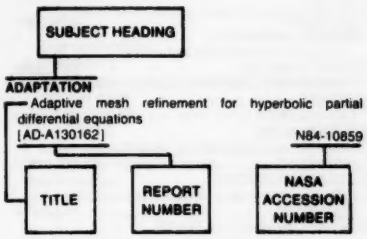
N84-23550# Aerospace Corp., El Segundo, Calif. Electronics Research Lab.
QUENCHINGS AND OUTBURSTS OF EXTRAGALACTIC RADIO SOURCES: NINE YEARS OF 3.3-mm MEASUREMENTS AND COMPARISONS WITH CENTIMETER-WAVE VARIATIONS
E. E. Epstein, W. G. Fogarty, J. Mottmann, and E. Schneider 15 Dec. 1983 48 p Prepared in cooperation with International Business Machines Corp., Milwaukee, Wis. and California Polytechnic State Univ., San Luis Obispo Original contains color illustrations
(Contract F04701-83-C-0084)
(AD-A138233; TR-0084(4925-07)-3; SD-TR-83-86) Avail: NTIS HC A03/MF A01 CSCL 03/2

The extragalactic variable radio sources 3C, 84, 3C 120, OJ 287, 3C 273, and BL Lac have been observed frequently at 3.3 mm for up to 9 years; the results are compared with 19-, 28-, 38-, and 45-mm observations. (1) The 3-mm variations are often rapid; significant information is lost if observations are not made every 1 - 3 days. (2) The correlation between the 3-mm and centimeter-wave variations of these five sources ranges from the 3-mm and centimeter-wave variations of these five sources ranges from high to almost non-existent; in general, the flatter the spectrum, the better the correlation. (3) The relationship between time lag and wavelength for possibly-connected outbursts appears to be characteristically different for different objects. (4) No pronounced 3-mm outbursts on a time scale of one to a few days were observed, but three sharp drops or quenchings were. A list of other quenchings found in the literature is included. (5) The amplitudes of outbursts vary as lambda to the kth power, where <k> approx. -0.4, from 3.3 to 111 mm, a factor of 34. Results 4 and 5 may place significant new constraints on models.
Author (GRA)

99 GENERAL

No abstracts in this category.

Typical Subject Index Listing



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A

ABLATION
A novel X-ray backlighting method for Rayleigh-Taylor instability measurements on ablatively driven targets
[AD-A138644] N84-22937

ABRASION
Role of abrasion in the optical polishing of metals and glass
[DE84-005737] N84-23259

ABSORPTION SPECTRA
Infrared astronomy research and high altitude observations
[NASA-CR-173526] N84-23413
Publications resulting from Infrared Astronomy Research and High Altitude Observations
[NASA-CR-173525] N84-23414

ABSORPTION SPECTROSCOPY
Optical gas temperature measurement in gas turbines
[PNR-90174] N84-22572

ABSTRACTS
The Shock and Vibration Digest, volume 16, no. 3
[AD-A139707] N84-22976
Mechanized contract document preparation and abstract system
[AD-P002750] N84-23297

ACCELERATED LIFE TESTS
Fine line electromigration. The effect of crossed thermal gradients
[AD-A138854] N84-23279

ACCELERATION PROTECTION
Factors affecting human tolerance to sustained acceleration
[AD-A138520] N84-23101
Effects of a negative G strap on restraint dynamics and human impact response
[AD-A138642] N84-23121

ACCELERATION TOLERANCE
Factors affecting human tolerance to sustained acceleration
[AD-A138520] N84-23101

ACCEPTABILITY
Environmental qualification tests, signal conditioning unit, SD602 materials experiment
[AD-A138910] N84-22897

ACCOUNTING
Cost accounting standards: A time for government and industry action
[AD-P002767] N84-23314

ACCRETION DISKS
Origin and evolution of the Saturn system N84-23433
Physics and chemistry in the primitive solar nebula
[MPE-PREPRINT-21] N84-23547

ACCUMULATIONS
Conditions for inflammation of accumulated aluminum in the propellant combustion zone N84-22660

ACCURACY
Performance evaluation of a Magnavox GPS (Global Positioning System) Z-set
[AD-A138569] N84-22547
Civil turbofan propulsion system integration studies using powered testing techniques at ARA, Bedford
[ARA-MEMO-246] N84-22561
Personnel technology: Performance appraisal, a process approach
[AD-A138359] N84-23112

ACETYLENE
Use of a polyacetylene cathode in primary lithium-thionyl chloride cells
[AD-A138791] N84-22896

ACID RAIN
Effects of mesoscale weather distrubances on contamination concentrations
[DE84-005753] N84-23036

ACOUSTIC EMISSION
Acoustic emission: A brief introduction to some of its uses in the aero engine industry
[PNR-90172] N84-22571

ACOUSTIC IMPEDANCE
Acoustic ground impedance meter
[NASA-CASE-LAR-12995-1] N84-22933

ACOUSTIC INSTABILITY
Direct measurement of high frequency solid propellant response functions N84-22649

ACOUSTIC LEVITATION
Acoustic rotation control
[NASA-CASE-NPO-15689-1] N84-23233

ACOUSTIC MEASUREMENT
Analysis of acoustic chamber pressure oscillations in shuttle high-pressure SRB's N84-22651
Acoustic ground impedance meter
[NASA-CASE-LAR-12995-1] N84-22933

ACOUSTIC PROPERTIES
Rocket motor aeroacoustics N84-22642
Coupling between velocity oscillations and solid propellant combustion N84-22643
Three-dimensional vorticity procedure interactions in combustion instability analysis of solid propellant rocket motors N84-22647
Effect of pressure on the static and dynamic acoustic properties of porous rubber
[AD-A138744] N84-22758
State-space structures for the realization of low roundoff noise digital filters N84-22900

ACOUSTIC SCATTERING
Automatic elimination of static unbalance of rotor in anisotropic bearings N84-22803

ACOUSTIC SIMULATION
Parametric and nonparametric Fast Kalman echo cancellation N84-22901

ACOUSTIC VELOCITY
Coupling between velocity oscillations and solid propellant combustion N84-22643
Three-dimensional vorticity procedure interactions in combustion instability analysis of solid propellant rocket motors N84-22647
Compressibility of colloids. 2: Compressibility studies of tri-block non-ionic polymers in toluene and water solutions
[AD-A138736] N84-22755

ACOUSTICS
Distributed estimation in the MIT/LL (Massachusetts Institute of Technology/Lincoln Laboratory) DSN (Distributed Sensor Networks) test-bed
[AD-P002697] N84-22858
Acoustic rotation control
[NASA-CASE-NPO-15689-1] N84-23233

ACOUSTO-OPTICS
Computer controlled laser optoacoustic spectroscopy for trace gas analysis N84-22710

ACQUISITION
Image acquisition and manipulation system
[AD-A138927] N84-23153
A quality improvement strategy for systems acquisition
[AD-P002620] N84-23365

ACTIVATION ENERGY
The influence of specific reactant-solvent interactions on intrinsic activation entropies for outer-sphere electron transfer reactions
[AD-A139081] N84-22725

ACTIVE CONTROL
Active control of distributed structures N84-22618

ADAPTATION
Nearly optimal detection of signals in non-Gaussian noise
[AD-A138657] N84-22872
Behavioral biology of mammalian reproduction and development for a space station
[NASA-CR-173493] N84-23092

ADAPTIVE CONTROL
Multiple access adaptive antennas N84-22823
Adaptive array combined with spread spectrum in communications N84-22825
Reactively steered adaptive array (Resaa) N84-22826
Generalized adaptive node concept N84-22833
A digital adaptive array processing algorithm for communications N84-22834
Adaptive control strategies for computer-controlled manipulators N84-23114
Model reference adaptive control systems: The hybrid approach N84-23169

ADAPTIVE FILTERS
Enhancement of spread-spectrum systems through adaptive antenna techniques N84-22824
On a simple adaptive tracking filter
[AD-A138955] N84-23186

ADDITIVES
Radiation damage and defect behavior in ion-implanted, lithium counterdoped silicon solar cells
[NASA-TM-83646] N84-22890

ADHESION
The biochemistry and physiology of bacterial adhesion to surfaces
[AD-A138271] N84-23094

ADHESIVE BONDING
Moisture transport in composites during repair work
[AD-A138658] N84-22703
Ceramic-to-metal bonding for pressure transducers
[NASA-CR-173500] N84-22753

ADHESIVES
High temperature adhesives for structural applications: A review — aircraft engines
[PNR-90171] N84-22767

ADIABATIC CONDITIONS
An experimental estimate of the electron-tunneling distance for some outer-sphere electrochemical reactions
[AD-A139049] N84-23284

ADJOINTS
An introduction to adjoint techniques
[BAE-BT-11172] N84-23170

ADSORPTION
Surface-enhanced Raman spectroscopy of electrochemically characterized interfaces. Relations between Raman scattering intensity and surface coverage for simple anionic adsorbates
[AD-A139054] N84-22721

A method for evaluating the surface concentrations of 2 like-charged ions simultaneously adsorbed at an electrode-solution interface
[AD-A139074] N84-22724
AERODYNAMIC CHARACTERISTICS
Assessment of aerodynamic performance of V/STOL and STOVL fighter aircraft
[NASA-TM-85937] N84-22536
AERODYNAMIC COEFFICIENTS
Data acquisition and aerodynamic coefficient estimation at high angles of attack N84-22542
AERODYNAMIC CONFIGURATIONS
The design and operational development of self-streamlining 2-dimensional flexible walled test sections
[NASA-CR-172328] N84-22534
Development and analysis of a STOL supersonic cruise fighter concept
[NASA-TM-85777] N84-22553
Transonic flow around protruding corner with free streamline N84-22796
AERODYNAMIC DRAG
Model identification and parameter estimation of the power, lift, and drag of light aircraft from a single maneuver N84-22552
AERODYNAMIC HEATING
Interaction of unsteady spatial boundary layer with hypersonic flow near rapidly heated portion of surface N84-22794
AERODYNAMIC LOADS
Prediction of fatigue crack-growth patterns and lives in three-dimensional cracked bodies
[NASA-TM-85787] N84-22979
AERODYNAMIC NOISE
Acoustic environmental accuracy requirements for response determination
[NASA-CR-171003] N84-23234
Fan noise reduction achieved by removing tip flow irregularities behind the rotor - forward arc test configurations
[NASA-TM-83616] N84-23235
Aerodynamic sound generation by turbulent boundary layer flow along solid and compliant walls
[MPIS-116/1983] N84-23239
AERODYNAMIC STABILITY
Generation of vehicle wobbling by the unsteady flow field in a spinning solid propellant rocket motor N84-22648
AERODYNAMIC STALLING
Data acquisition and aerodynamic coefficient estimation at high angles of attack N84-22542
AERODYNAMICS
Characteristics of a prototype experiment N84-23140
AEROELASTICITY
Calculation of apparent masses in blade ring N84-22793
AERONAUTICAL ENGINEERING
Aeronautics and Space Engineering Board: Aeronautics Assessment Committee
[NASA-TM-85504] N84-22771
Cost effectiveness of reliability in the aerospace industry
[PNR-90187] N84-22971
AEROSOLS
Boron in the marine atmosphere N84-23038
Inversion of experimental optical data
[AD-A138979] N84-23257
Measurement and analysis of diffuse solar irradiance N84-23546
AEROSPACE INDUSTRY
Impact of corporate resource allocation decisions on national security objectives: Disynergism in aerospace industrial resource planning
[AD-P002801] N84-23347
The Score technique: An analytical approach for assessing the results of manufacturing reviews
[AD-P002838] N84-23383
AEROSPACE VEHICLES
Scattering of an electromagnetic plane wave from a perfectly electrically conducting half-plane in the proximity of planar media discontinuities
[AD-A138968] N84-22876
AFTERBURNING
Some themes on Rolls-Royce military engine technology. Part 1: Old and new engines for combat aircraft. Part 2: After-burning technology
[PNR-90195] N84-22579
Acoustic and photoelectric burnout detection of T-burner grains N84-22650
AGRISTARS PROJECT
CONSERVB: A numerical method to compute soil water content and temperature profiles under a bare surface
[E84-10113] N84-23006
A microwave systems approach to measuring root zone soil moisture
[E84-10114] N84-23007
AIR COOLING
Multi-small hole drilling by EDM --- electrodischarge machining (EDM)
[PNR-90184] N84-22813
AIR CURRENTS
Untapped midwestern wind energy resource: Nocturnal low-level wind maxima
[DE84-006424] N84-23077
AIR DEFENSE
Jam-resistant tactical communications N84-22828
A comparison of two air defense command and control models
[AD-P002876] N84-22837
AIR FLOW
Energetics of vortex ring formation
[AD-A138795] N84-22539
AIR LAW
Aircraft noise legislation: An overkill
[PNR-90167] N84-23037
AIR POLLUTION
Effects of mesoscale weather distrubances on contamination concentrations
[DE84-005753] N84-23036
Kinetic studies of atmospheric reactions of OH radicals N84-23050
Prediction of atmospheric flow and dispersion over sloping terrain N84-23056
The vertical redistribution of a pollutant tracer due to cumulus convection N84-23057
AIR SAMPLING
Observations of major stratospheric chlorine species
[AD-A138646] N84-23045
AIR TRAFFIC
System safety study of minimum TCAS II (Traffic Alert and Collision Avoidance System)
[AD-A138674] N84-22548
FAA (Federal Aviation Administration) aviation forecasts -Fiscal Years 1984-1995
[AD-A138759] N84-22549
AIR TRAFFIC CONTROL
En route/terminal ATC (Air Traffic Control) operations concept
[AD-A138991] N84-22550
AIR TRAFFIC CONTROLLERS (PERSONNEL)
En route/terminal ATC (Air Traffic Control) operations concept
[AD-A138991] N84-22550
AIR WATER INTERACTIONS
Handbook of geophysics and space environments, Chapter 15, 1983 revision: Atmospheric temperature, density and pressure
[AD-A138646] N84-23076
AIRBORNE EQUIPMENT
Airborne lidar for oceanography and hydrology (FLOH)
[ESA-TT-799] N84-22955
AIRBORNE/SPACEBORNE COMPUTERS
Reprogrammable onboard mission of IRAS
[NLR-MP-83014-U] N84-22600
AIRCRAFT
Yellow ophthalmic filters in the visual acquisition of aircraft
[AD-A138536] N84-23097
AIRCRAFT CONSTRUCTION MATERIALS
Clarification of environmental effects in stress corrosion cracking
[AD-A138581] N84-22737
High temperature adhesives for structural applications: A review --- aircraft engines
[PNR-90171] N84-22767
AIRCRAFT CONTROL
V/STOL maneuverability and control
[NASA-TM-85939] N84-22584
AIRCRAFT DESIGN
V/STOL concepts in the United States: Past, present, and future
[NASA-TM-85938] N84-22532
Development and analysis of a STOL supersonic cruise fighter concept
[NASA-TM-85777] N84-22553
Technology review of flight crucial flight controls
[NASA-CR-172332] N84-22583
AIRCRAFT ENGINES
Acoustic emission: A brief introduction to some of its uses in the aero engine industry
[PNR-90172] N84-22571
High temperature adhesives for structural applications: A review --- aircraft engines
[PNR-90171] N84-22767
Vortex generating flow passage design for increased film-cooling effectiveness and surface coverage --- aircraft engine blade cooling
[NASA-TM-83617] N84-22909
Proven design + new technology = reliability + economy --- aircraft engines
[PNR-90199] N84-22973
AIRCRAFT EQUIPMENT
A Generalized Escape System Simulation (GESS) computer program: GESS user's guide, version 2, volume 1
[AD-A138844] N84-22545
Preliminary experience with a stereoscopic video system in a remotely piloted aircraft application
[NASA-TM-84909] N84-22557
AIRCRAFT INDUSTRY
Cost effectiveness of reliability in the aerospace industry
[PNR-90187] N84-22971
AIRCRAFT MANEUVERS
V/STOL maneuverability and control
[NASA-TM-85939] N84-22584
Device 2E6 (ACMS) Air Combat Maneuvering Simulator instructor console review
[AD-A138972] N84-22587
AIRCRAFT NOISE
Aircraft noise legislation: An overkill
[PNR-90167] N84-23037
AIRCRAFT PRODUCTION
Engine affordability --- aircraft engines
[PNR-90178] N84-22574
AIRCRAFT PRODUCTION COSTS
An automated airframe production cost model
[AD-P002787] N84-23334
Independent cost estimates: A case study joint vertical lift aircraft (JVX) program
[AD-P002797] N84-23343
AIRCRAFT RELIABILITY
SIRE: An integrated reliability and cost model for the aerospace industry --- System Integrated Reliability Evaluator (SIRE)
[PNR-90192] N84-22972
AIRCRAFT STRUCTURES
The application of cold worked holes (in aircraft structures)
[NLR-TR-81120-U] N84-22960
AIRCRAFT SURVIVABILITY
Educational aids in aircraft combat survivability
[AD-A139090] N84-22556
AIRFOILS
Transonic flow calculations using triangular finite elements N84-22529
Calculation of the flow over a stalled airfoil N84-22531
The design and operational development of self-streamlining 2-dimensional flexible walled test sections
[NASA-CR-172328] N84-22534
ALESEP: A computer program for the analysis of airfoil leading edge separation bubbles
[NASA-CR-172310] N84-22537
AIRFRAMES
A review study of nondestructive test techniques for residual stresses in aircraft transparencies
[AD-A138930] N84-22555
Moisture transport in composites during repair work
[AD-A138658] N84-22703
ALASKA
Planetary geomorphology field studies: Washington and Alaska N84-23501
ALBEDO
Atmospheric model development N84-22998
Topography on Ganymede derived from photoclinometry N84-23442
Classification of volcanoes of the Kane Patera Quadrangle of Io: Proportions of lava flows and pyroclastic flows N84-23477
ALGEBRA
Annals of the Fourier Institute, volume 33, no. 4
[ISSN-0373-0956] N84-23172
The Fourier Plancherel transform of the analytic Lie group. 1: Weyl algebras and differential operators N84-23178
Process algebra semantics for queues
[MC-IW-241/83] N84-23219
ALGORITHMS
Analysis of inviscid and viscous flows in cascades with an explicit multiple-grid algorithm
[NASA-TM-83636] N84-22527
Quantification of subjective ratings through conjoint measurement analysis
[AD-A138810] N84-22554
Numerical analysis of an unsteady shock in an inlet diffuser N84-22686
Numerical predictions of residence times behind a rearward facing step with transverse injection N84-22687
Balancing of flexible rotors with simultaneous precise determination of influencing factors N84-22808
A digital adaptive array processing algorithm for communications N84-22834
A model for asynchronous distributed computation
[AD-P002879] N84-22840

Distributed estimation in the MIT/LL (Massachusetts Institute of Technology/Lincoln Laboratory) DSN (Distributed Sensor Networks) test-bed
[AD-P002897] N84-22856
A framework for evaluation of surveillance algorithms
[AD-P002901] N84-22859
Compression algorithm for data analysis in a radio link (preparation of PACEM 2 experiment)
[CRPE-NT-121] N84-22881
Parametric and nonparametric Fast Kalman echo cancellation N84-22901
Data compression
[AD-A138541] N84-23124
Transformations of software design and code may lead to reduced errors N84-23145
Image acquisition and manipulation system
[AD-A138927] N84-23153
Implementation of an optimal multicommodity network flow algorithm based on gradient projection and a path flow formulation
[AD-A138935] N84-23154
The representation and synthesis of design specifications for distributed software systems N84-23163
Factoring multivariate integral polynominals
[MC-IW-229/83] N84-23190
Factoring multivariate integral polynomials, part 2
[MC-IW-230/83-PT-2] N84-23191
The early roots of Babylonian mathematics. Part 3: Three remarkable texts from Elba
[CTH-MATH-196314-PT-3] N84-23197
Polynomial factorization by root approximation
[MC-IW-242/83] N84-23201

ALKENES
Organometallic chemistry of weakly solvated transition metal cations
[DE84-006997] N84-22726

ALKYL COMPOUNDS
Process for preparing perfluorotriazine elastomers and precursors thereof
[NASA-CASE-ARC-11402-1] N54-22744

ALLOCATIONS
The design of information structures: Basic allocation strategies for organizations
[AD-P002909] N84-22861
Optimal file allocation problems for distributed data bases in unreliable computer networks, 2
[AD-P002913] N84-22864

ALLUVIUM
A regression model for the temporal development of soil pipes and associated gullies in the alluvial-fill valley of the Rio Puerco, central New Mexico N84-23502

ALTERNATING CURRENT
Motor power control circuit for ac induction motors
[NASA-CASE-MFS-25323-1] N84-22886

ALTIMETERS
Topex: Observing the oceans from Space
[NASA-CR-173490] N84-23085

ALTITUDE SIMULATION
Spectroscopic measurements of the Laser-HANE plasma
[AD-A138685] N84-22947

ALUMINUM
Conditions for inflammation of accumulated aluminum in the propellant combustion zone N84-22660
Combustion of high-aluminum-content propellants N84-22661
Revision of design values for 7075-T7351 and 7075-T7651 aluminum plate
[AD-A139092] N84-22740

ALUMINUM ALLOYS
Review of the effects of microstructure on fatigue in aluminum alloys
[NASA-TM-83626] N84-22735
Clarification of environmental effects in stress corrosion cracking
[AD-A138581] N84-22737
The fatigue of powder metallurgy alloys
[AD-A138714] N84-22738
Prediction of fatigue crack-growth patterns and lives in three-dimensional cracked bodies
[NASA-TM-85787] N84-22979
Corrosion and load transfer effects on fatigue of mechanically fastened joints. Fatigue of zero load transfer specimen
[AD-A139042] N84-22985
The application of cold worked holes (in aircraft structures)
[NLR-TR-81120-U] N84-22990
The Record of Electrical and Communication Engineering Conversazione Tohoku University, volume 52, no. 4
[ISSN-0385-7719] N84-23228
All-aluminum-alloy UHV chamber for molecular beam epitaxy, 1 N84-23229

ALUMINUM COATINGS
Thermodynamics and kinetics of the gas phase and pack aluminide coating formation on iron and steel N84-23291

ALUMINUM GRAPHITE COMPOSITES
Select fiber composites for space applications: A mechanistic assessment
[NASA-TM-83631] N84-22702

ALUMINUM OXIDES
High temperature failure mechanisms in ceramic polycrystals
[DE84-006641] N84-22764
Characterization of humidity sensors and physical properties of h20
[AD-A139024] N84-22938

AMAZON REGION (SOUTH AMERICA)
Application of Magsat lithospheric modeling in South America. Part 1: Processing and interpretation of magnetic and gravity anomaly data
[E84-10115] N84-23008

AMINO ACIDS
Primary patterns of electronically excited molecules in the gas phase 2
[MPIS-9/1983] N84-23245

AMMONIA
The reaction NH2 + PH3 yields NH3 + PH2: Absolute rate constant measurement and implication for NH3 and PH3 photochemistry in the atmosphere of Jupiter
[NASA-TM-85063] N84-23430

AMMONIUM COMPOUNDS
Combustion thermodynamics of some boron-nitrogen-hydrogen compounds N84-22684

AMMONIUM NITRATES
Status of ammonium nitrate in propellants and explosives N84-22655
Discrete charge diagnostics on Pre-DIRECT COURSE
[AD-A139073] N84-22919

AMORPHOUS MATERIALS
Bulk formation of metallic glasses and amorphous silicon from the melt
[NASA-CR-171012] N84-22752

AMPLIFIERS
Low noise tuned amplifier
[NASA-CASE-GSC-12567-1] N84-22887

AMPLITUDES
Study and design of a cylindrical lens array antenna for wideband electronic scanning
[AD-A138808] N84-22875
Acoustic rotation control
[NASA-CASE-NPO-15689-1] N84-23233

ANALOG CIRCUITS
Signal processing circuit development
[AD-A138648] N84-22870

ANALOGS
Curvilinear ground on Mars: The search for terrestrial analogs N84-23508

ANALYSIS OF VARIANCE
An analysis of the acquisition strategy decision process along three dimensions of the acquisition improvement program
[AD-P002758] N84-23305

ANALYTIC FUNCTIONS
Annals of the Fourier Institute, volume 33, no. 4
[ISSN-0373-0956] N84-23172
On a fundamental inequality and the singularities of an analytic function defined by the LC-Dirichletian element N84-23177
Exponential calculus of microdifferential operators of infinite order, part 1 N84-23181

ANDES MOUNTAINS (SOUTH AMERICA)
Radar-visible wind streaks in the Altiplano of Bolivia N84-23527

ANECHOIC CHAMBERS
Analysis of acoustic chamber pressure oscillations in shuttle high-pressure SRB's N84-22651

ANEMOMETERS
Particle sizing in a fuel rich airbreathing engine combustor N84-22634

ANGLE OF ATTACK
Data acquisition and aerodynamic coefficient estimation at high angles of attack N84-22542

ANHYDRIDES
Fire and heat resistant laminating resins based on maleimido substituted aromatic cyclotriphosphazenes
[NASA-CASE-ARC-11428-1] N84-22697

ANIMALS
The use of a small digital computer for on-line behavioral experiments
[AD-A138975] N84-23126

ANISOTROPY
Approach to solving problem of acoustic wave diffraction by elastic shell N84-22804

ANNUAL VARIATIONS
A study of Western North Pacific tropical storms and typhoons that intensify after recurvature
[AD-A138792] N84-23075
The effect of interior motion on seasonal thermocline evolution
[AD-A138270] N84-23088

ANOMALIES
A classical picture of anomalous effects in a Tokamak
[IPPJ-664] N84-23263

ANTARCTIC REGIONS
Weathered stony meteorites from Victoria Land, Antarctica, as possible guides to rock weathering on Mars N84-23509
Salts in the dry valleys of Antartica N84-23510
Planetary geomorphology field studies: Iceland and Antarctica N84-23514

ANTENNA ARRAYS
Research Trends in Military Communications
[AD-A138229] N84-22821
Adaptive array combined with spread spectrum in communications N84-22825
A digital adaptive array processing algorithm for communications N84-22834
Focal region characteristics of focused microwave array antennas
[AD-A138557] N84-22867
Study and design of a cylindrical lens array antenna for wideband electronic scanning
[AD-A138808] N84-22875

ANTENNA DESIGN
Study of wind scatterometer antenna for ERS-1. Volume 1: Executive summary report
[Y/A-3360] N84-23080
Study of windscatterometer antenna for ERS-1
[MIX/A-3188] N84-23081

ANTENNA RADIATION PATTERNS
Focal region characteristics of focused microwave array antennas
[AD-A138557] N84-22867

ANTENNAS
Multiple access adaptive antennas N84-22823
Enhancement of spread-spectrum systems through adaptive antenna techniques N84-22824
Spread spectrum networks N84-22831

ANTISUBMARINE WARFARE
Tactical decision aids which quantify judgment
[AD-P002889] N84-22850

APHELIONS
Comet nucleus sample return mission
[NASA-CR-173501] N84-22592

APPROXIMATION
Parameterization and approximation methods in feedback theory with applications in high gain, fast sampling and cheap optimal control
[RR-241] N84-23167
Big omega versus the wild functions
[MC-IW-239/83] N84-23200

ARC DISCHARGES
Cathode degradation and erosion in high pressure arc discharges
[NASA-TM-83638] N84-22631

ARC JET ENGINES
Cathode degradation and erosion in high pressure arc discharges
[NASA-TM-83638] N84-22631

ARC SPRAYING
Diamondlike flakes
[NASA-CASE-LEW-13837-2] N84-22696

ARC WELDING
Development of holographic interferometry for welding arc analysis
[DE84-005454] N84-22940

ARCHITECTURE (COMPUTERS)
A survey of European robotics research
[AD-A138952] N84-23122
Machine vision: Three generations of commercial systems
[AD-A139037] N84-23123
A high speed processor for binary images
[AD-A138908] N84-23125
Feasibility studies of optical processing of image bandwidth compression schemes
[AD-A138736] N84-23254

ARMED FORCES (UNITED STATES)
Individual differences in military decisionmaking: The classification performance of active sonar operators
[AD-P002885] N84-22846
The leader of the Army acquisition workforce
[AD-P002762] N84-23309
Air Force Systems Command research planning guide (research objectives)
[AD-A138851] N84-23384

ARRAYS
High angular resolution microwave sensing with large, sparse, random arrays
[AD-A138717] N84-22874
Multi-sensor array time-delay estimation with small phase incoherences
[AD-A138867] N84-23183

ARTIFICIAL INTELLIGENCE
Alternative knowledge acquisition interface structures [AD-A139019] N84-23109
Documentation for the machine-readable version of the Survey of the Astrographic Catalogue From 1 to 31 Degrees of Northern Declination (Fresneau 1983) [NASA-TM-85569] N84-23421

ARTIFICIAL SATELLITES
Stochastic technique applied to the smoothing treatment of bias and compression of artificial satellite tracking and telemetry data [INPE-2909-TDL/148] N84-22804
Comparisons of sea-surface temperature obtained from ship and satellite data [AD-A138257] N84-23087

ASBESTOS
Separator development and testing of nickel-hydrogen cells [NASA-TM-83653] N84-22712

ASSESSMENTS
Priorities for detailed quality assessments of the National Defense Stockpile nonfuel materials [NIMAB-403] N84-23011

ASTEROIDS
Wave drag of elongated astroid bodies at moderate supersonic flight velocities N84-22797
The planet crossing asteroid survey: Progress in the analysis of populations and terrestrial-planet cratering rates N84-23449

ASTROLOY (TRADEMARK)
The cyclic behaviour of a powder Ni-base superalloy — aircraft engines [PNR-90182] N84-22743

ASTRONOMICAL CATALOGS
Documentation for the machine-readable version of a supplement to the Bright Star catalogue (Hoffleit, Saladyga and Wlasuk 1983) [NASA-TM-85573] N84-23415
Documentation for the machine-readable version of the catalogue of 20457 Star positions obtained by photography in the declination zone -48 deg to -54 deg (1950) [NASA-TM-85572] N84-23416
Documentation for the machine-readable version of a table of Redshifts for Abell clusters (Sarazin, Rood and Struble 1982) [NASA-TM-85571] N84-23417
Documentation for the machine-readable version of the SAO-HD-GC-DM cross index version 1983 [NASA-TM-85570] N84-23418
Documentation for the machine-readable version of the Smithsonian Astrophysical Observatory Star catalogue (SAO) version 1984 [NASA-TM-85574] N84-23419
Documentation for the machine-readable version of the general catalogue of 33342 stars for the epoch 1950 (Boss 1937) [NASA-TM-85568] N84-23420
Documentation for the machine-readable version of the Survey of the Astrographic Catalogue From 1 to 31 Degrees of Northern Declination (Fresneau 1983) [NASA-TM-85569] N84-23421

ASTRONOMICAL MAPS
Documentation for the machine-readable version of the Survey of the Astrographic Catalogue From 1 to 31 Degrees of Northern Declination (Fresneau 1983) [NASA-TM-85569] N84-23421

ASTRONOMICAL MODELS
Cometary nucleus and active regions N84-23450

ASTRONOMICAL PHOTOGRAPHY
Galilean satellite multispectral data base production N84-23521

ASTRONOMICAL PHOTOMETRY
Infrared astronomy research and high altitude observations [NASA-CR-173526] N84-23413
Publications resulting from Infrared Astronomy Research and High Altitude Observations [NASA-CR-173525] N84-23414
Multi-image photometric solutions for the Galilean satellites N84-23522
Rapid extraction of relative topography from Viking orbiter images. 2: Application to irregular topographic features N84-23523

ASTRONOMICAL SPECTROSCOPY
Activities report of the Institute for Extraterrestrial Physics N84-23407
Surface compositions in the Aristarchus Region: Implications for regional stratigraphy N84-23519
A case for olivine on Mars N84-23520

ASTROPHYSICS
Central burst of simultaneously rotating and gravitating body N84-22783
Activities report of the Institute for Extraterrestrial Physics N84-23407

ASYMPTOTIC METHODS
Asymptotic condensed phase analysis of deflagrating monopropellants with subsurface exothermicity N84-22656
Asymptotic models for wave scattering from very rough surfaces N84-22883

ASYMPTOTIC SERIES
Transonic flow around protruding corner with free streamline N84-22796

ATMOSPHERIC ATTENUATION
Study of the 13 GHz signal attenuation due to tropical rains [CRPE-NT-113] N84-22879

ATMOSPHERIC CHEMISTRY
Effects of mesoscale weather distrubances on contamination concentrations [DE84-005753] N84-23036
Kinetic studies of atmospheric reactions of OH radicals N84-23050
Kinetics and products of the reaction OH + HNO3 N84-23051
The reaction NH2 + PH3 yields NH3 + PH2: Absolute rate constant measurement and implication for NH3 and PH3 photochemistry in the atmosphere of Jupiter [NASA-TM-85063] N84-23430

ATMOSPHERIC CIRCULATION
Effects of mesoscale weather distrubances on contamination concentrations [DE84-005753] N84-23036
Prediction of atmospheric flow and dispersion over sloping terrain N84-23056
The vertical redistribution of a pollutant tracer due to cumulus convection N84-23057

ATMOSPHERIC COMPOSITION
Observations of major stratospheric chlorine species [AD-A138646] N84-23045
MM-wavelength measurements of CO in the atmosphere of Mars and SO2 in the atmosphere of Venus N84-23429
Origin and evolution of the Saturn system N84-23433

ATMOSPHERIC CORRECTION
LANDSAT-D investigations in snow hydrology [E84-10094] N84-22997
LANDSAT 4 band 6 data evaluation [E84-10119] N84-23009

ATMOSPHERIC DENSITY
Handbook of geophysics and space environments, Chapter 15, 1983 revision: Atmospheric temperature, density and pressure [AD-A138846] N84-23076

ATMOSPHERIC IONIZATION
User's manual of a program to compute the distribution of photoelectrons — atmospheric ionization [CRPE-NT-110] N84-23054

ATMOSPHERIC MODELS
Atmospheric turbulence simulation for Shuttle orbiter [NASA-CR-171013] N84-22602
Atmospheric model development N84-22998
Effects of mesoscale weather distrubances on contamination concentrations [DE84-005753] N84-23036
Atmospheric correction study/atmospheric model optimization [INPE-2969-RPE/448] N84-23040
A middle latitude ionospheric model [CRPE-NT-114] N84-23049
Influence of extratropical heteorological phenomenon on the northeast Brazilian climate: A study using finite elements [INPE-2912-PRE/425] N84-23072
Martian paleoclimate N84-23427
MM-wavelength measurements of CO in the atmosphere of Mars and SO2 in the atmosphere of Venus N84-23429

ATMOSPHERIC OPTICS
Correlation between the meteorological parameters and the optical strength of atmospheric turbulence close to the ground. Part 3: Results [BAE-BT-10771] N84-23070

ATMOSPHERIC PRESSURE
Handbook of geophysics and space environments, Chapter 15, 1983 revision: Atmospheric temperature, density and pressure [AD-A138846] N84-23076

ATMOSPHERIC REFRACTION
Correlation between the meteorological parameters and the optical strength of atmospheric turbulence close to the ground. Part 3: Results [BAE-BT-10771] N84-23070

ATMOSPHERIC SOUNDING
A statistical evaluation and comparison of VISSR Atmospheric Sounder (VAS) data and corresponding rawinsonde measurements [NASA-TM-82575] N84-23071
Application of VISSR Atmospheric Sounder (VAS) data [NASA-TM-82574] N84-23073

ATMOSPHERIC TEMPERATURE
Handbook of geophysics and space environments, Chapter 15, 1983 revision: Atmospheric temperature, density and pressure [AD-A138846] N84-23076

ATMOSPHERIC TURBULENCE
Atmospheric turbulence simulation for Shuttle orbiter [NASA-CR-171013] N84-22602

ATOMIC COLLISIONS
A classical picture of anomalous effects in a Tokamak [IPPJ-664] N84-23263

ATOMIC EXCITATIONS
Electronically excited products in the reactions of O(3PJ) atoms with halogenated ethenes [MPIS-6/1983] N84-23244

ATOMIC SPECTRA
Current trends in atomic spectroscopy [PB84-162957] N84-22732

ATTENTION
Cognitive performance change during a 6-hour hike at low temperature in simulated rain, at controlled walking rates [AD-A138358] N84-23100

ATTITUDE CONTROL
Space Station Systems Technology Study. Volume 1: Executive summary [NASA-CR-171014] N84-22614
Attitude and shape control of large space structures N84-23091
Programmable scan/read circuitry for charge coupled device imaging detectors — spacecraft attitude control and star trackers [NASA-CASE-NPO-15345-1] N84-23247

AUDITORY TASKS
Frequency encoded auditory display of the critical tracking task [NASA-TM-85869] N84-22558

AUGER SPECTROSCOPY
X-ray photoelectron and Auger electron spectroscopic study of the CdTe surface resulting from various surface pretreatments: Correlations of photoelectrochemical and capacitance-potential behavior with surface chemical composition [AD-A138601] N84-22714

AURORAL ZONES
Observations of short period magnetic pulsations during the SBARMO-79 campaign: Data summary [REPT-90/1982] N84-23052

AURORAS
Activities report of the Institute for Extraterrestrial Physics N84-23407

AUSTENITIC STAINLESS STEELS
Fracture toughness processes [DE84-007244] N84-22989

AUTOMATA THEORY
A survey of European robotics research [AD-A138952] N84-23122

AUTOMATIC CONTROL
Research in man-machine interaction discussed N84-23393

AUTOMATION
Office automation in the acquisition environment [AD-P002747] N84-23294

AUTOMOBILES
The CARFAX road traffic information system [BBC-RD-1984/1] N84-22818

AUXILIARY EQUIPMENT (COMPUTERS)
Numeric keyboard layout and computer menu selection [BAE-BT-11969] N84-23116

AVALANCHES
Drainage evolution in the debris avalanche deposits near Mount Saint Helens, Washington N84-23496

AVIONICS
Integrated testing and maintenance technologies [AD-A138587] N84-22528
Technology review of flight crucial flight controls [NASA-CR-172332] N84-22583
The avionics integrity program (AVIP) [AD-P002817] N84-23362

AWARDS
Landmarks of progress N84-23397

AXIAL FLOW
Effect of oscillations upon velocity distributions in simulated solid propellant flow environments N84-22646

AXISYMMETRIC FLOW
Axisymmetric MHD equilibria with flow — Tokamaks [IPP-6/230/] N84-23262

AZIDES (INORGANIC)
A shock tube study of chlorine azide decomposition N84-22728

AZIDES (ORGANIC)
The onset of detonation behind incident shock waves in chlorine azide-argon mixtures N84-22921

B

BACKSCATTERING
Energy loss of 24.8-MeV electrons by interacting with thick layers of C, Al, Cu, and Pb [ETL-836] N84-23277
Radar backscatter modelling N84-23525
BACTERIA
The biochemistry and physiology of bacterial adhesion to surfaces [AD-A138271] N84-23094
BAFFLES
A new satellite instrument for yaw and pitch measurements [AD-A136729] N84-22599
BALL BEARINGS
Approach to solving problem of acoustic wave diffraction by elastic shell N84-22804
Balancing of flexible rotors with simultaneous precise determination of influencing factors N84-22808
BALLISTICS
The 20th JANNAF Combustion Meeting, volume 1 [AD-A138033] N84-22632
BANACH SPACE
Symmetric systems with semisimple structure algebra: The quaternionic case [NASA-CR-173421] N84-23193
BANDPASS FILTERS
Low noise tuned amplifier [NASA-CASE-GSC-12567-1] N84-22687
BANDWIDTH
Precise measurement of refractive index and absorption coefficient of near millimeter wave and far infrared materials [AD-A138656] N84-23253
Feasibility studies of optical processing of image bandwidth compression schemes [AD-A136736] N84-23254
BARIUM
Rayleigh-Taylor instability in the presence of a stratified shear layer [AD-A138544] N84-23043
BARREN LAND
CONSERVB: A numerical method to compute soil water content and temperature profiles under a bare surface [E84-10113] N84-23006
A microwave systems approach to measuring root zone soil moisture [E84-10114] N84-23007
BARS (LANDFORMS)
Experiments examining the shapes of isolated bars in comparison with those occurring in braided rivers N84-23503
BASALT
Ridges on basalt flows N84-23484
BATHYMETERS
Airborne lidar for oceanography and hydrology (FLOH) [ESA-TT-799] N84-22955
BATTERY CHARGERS
Chemically rechargeable battery [NASA-CASE-NPO-16024-1] N84-23020
BEAM CURRENTS
RFQ development at LBL [DE84-006762] N84-23271
BEARINGS
Plane motion of solid body on rough surface of annular bearing rotating about its axis perpendicular to plane of motion N84-22801
Measurements of elastohydrodynamic film thickness, wear and tempering behavior of high pressure oxygen turbopump bearings [NASA-CR-171006] N84-22960
BEDROCK
Venus: The nature of the surface from Venera panoramas N84-23459
BEHAVIOR
Behavioral biology of mammalian reproduction and development for a space station [NASA-CR-173493] N84-23092
The use of a small digital computer for on-line behavioral experiments [AD-A138975] N84-23126
BELLOWS
Bellows flow-induced vibrations [NASA-TM-82556] N84-22912
BENDING
A discrete-element analysis for large deflection of thin plates: A combined effect of geometric and material nonlinearities N84-22995
BENDING MOMENTS
Improved compliant hydrodynamic fluid journal bearing [NASA-CASE-LEW-13670-1] N84-22989
Wave attenuation in periodic structures [AD-A138934] N84-22994
BERYLLIUM
Development of high strength braze joints in beryllium [DE84-007243] N84-22964
BESSEL FUNCTIONS
Computation of radiation in stratified media by Fast Fourier Transform (FFT) [AD-A136647] N84-22869
BIBLIOGRAPHIES
Bibliography of Soviet Laser Developments, Number 63, January-February 1983 [AD-A138742] N84-22948
Scientific activity in oceanography, 1979-1982 N84-23084
Bibliography on direct voice input and direct voice output [BAE-BT-12983] N84-23118
Bibliography of technical publications and papers, October 1982 - September 1983 [AD-A138907] N84-23403
Infrared astronomy research and high altitude observations [NASA-CR-173526] N84-23413
Publications resulting from Infrared Astronomy Research and High Altitude Observations [NASA-CR-173525] N84-23414
BINARY CODES
Trends in convolutional coding N84-22830
The Record of Electrical and Communication Engineering Conversazione Tohoku University, volume 52, no. 4 [ISSN-0385-7719] N84-23228
Transmitting two-level balanced code within the bandwidth of straight binary code-transmission N84-23231
BINARY FLUIDS
Analysis of the transfer function model of tray-type binary distillation columns with liquid hydraulic delay [RR-234] N84-22818
BINARY MIXTURES
Theoretical predictions for the phase stability of dense binary mixtures N84-23429
BINDERS (MATERIALS)
Research into the thermal decomposition of selected energetic material candidates (Project order ATL-2-094) [AD-A136730] N84-22770
BINOCULAR VISION
Preliminary experience with a stereoscopic video system in a remotely piloted aircraft application [NASA-TM-84909] N84-22557
BIOASSAY
The biochemistry and physiology of bacterial adhesion to surfaces [AD-A138271] N84-23094
BIOCHEMISTRY
The biochemistry and physiology of bacterial adhesion to surfaces [AD-A138271] N84-23094
BIODYNAMICS
Effects of a negative G strap on restraint dynamics and human impact response [AD-A136842] N84-23121
BIOLOGICAL EFFECTS
Behavioral biology of mammalian reproduction and development for a space station [NASA-CR-173493] N84-23092
BIOTECHNOLOGY
West Europe report: Science and technology [JPRS-WST-84-011] N84-23224
BIPOLAR TRANSISTORS
High voltage-high power components for large space power distribution systems [NASA-TM-83648] N84-22615
BIPOLARITY
Teardown analysis of a ten cell bipolar nickel-hydrogen battery [NASA-TM-83618] N84-23026
Thomson semiconductors bipolar IC strategy to 1986 N84-23227
BIT ERROR RATE
Fast evaluation of the numerical error rate in the presence of intersymbolic interference [CRPE-NT-127] N84-23158
BITUMENS
Oil shale extraction using super-critical extraction [NASA-CASE-NPO-15858-1] N84-23012
BLACK BODY RADIATION
Temperature, concentration, and size measurements in turbulent reactive flows N84-22833
BLADE TIPS
Tip cap for a rotor blade [NASA-CASE-LEW-13654-1] N84-22580
A high temperature optical displacement measuring system — gas turbine blades [PNR-90186] N84-23261
BLANKETS (FUSION REACTORS)
Moving ring reactor KARIN-I [IPPJ-660] N84-23265
BLASTS
Grit blasting a distributed roughness based on a 30% probability of exceedence [AD-A138779] N84-22809
BODY TEMPERATURE
Cognitive performance change during a 6-hour hike at low temperature in simulated rain, at controlled walking rates [AD-A138358] N84-23100
BODY-WING CONFIGURATIONS
Visualisation of the vortex dominated flow around a delta wing-body combination using a water tunnel [BAE-621/RES/6631] N84-22904
BOLIVIA
Radar-visible wind streaks in the Altiplano of Bolivia N84-23527
BOLTS
Strength of bolted joints in laminated composites N84-22992
BOLTZMANN TRANSPORT EQUATION
Loeb solutions of the Boltzmann equation [CTH-MATH-1983-82] N84-22926
BOOSTER ROCKET ENGINES
Analysis of acoustic chamber pressure oscillations in shuttle high-pressure SRB's N84-22651
BORANES
Combustion thermodynamics of some boron-nitrogen-hydrogen compounds N84-22684
BOREHOLES
Analysis of production data from the Krafla geothermal field, Iceland [DE84-006881] N84-23014
BORIDES
Method of making a light weight battery plaque [NASA-CASE-LEW-13349-1] N84-22734
BORN APPROXIMATION
Calculation procedures for variational, Born and exact solutions for electromagnetic scattering from two randomly separated dielectric Rayleigh cylinders [AD-A138543] N84-22865
BORON
Boron in the marine atmosphere N84-23038
BORON CARBIDES
Theoretical influence of the deposition conditions on the uniformity of boron carbide coatings N84-22707
BOUNDARIES
Exact solution to problem of interaction between wedge moving at supersonic velocity and interface of two gaseous media N84-22790
BOUNDARY LAYER COMBUSTION
The calculation of the heat transfer associated with the injection of methane gas at the stagnation point of the dissociated boundary layer of the laminar air flow [AD-A139063] N84-22918
BOUNDARY LAYER EQUATIONS
Transonic flow around protruding corner with free streamline N84-22796
Wave drag of elongated astroid bodies at moderate supersonic flight velocities N84-22797
BOUNDARY LAYER FLOW
Aerodynamic sound generation by turbulent boundary layer flow along solid and compliant walls [MPIS-116/1983] N84-23239
Hydrodynamic theory of convective transport across a dynamically stabilized diffuse boundary layer — plasma flow [JUEL-1869] N84-23275
BOUNDARY LAYER SEPARATION
ALESEP: A computer program for the analysis of airfoil leading edge separation bubbles [NASA-CR-172310] N84-22537
BOUNDARY LAYER STABILITY
Excitation of Tollmin-Schlichting waves in boundary layer at vibrating surface of infinite-span sweptback wing N84-22792
BOUNDARY LAYERS
Numerical analysis of an unsteady shock in an inlet diffuser N84-22686
BOUNDARY VALUE PROBLEMS
Energetics of vortex ring formation [AD-A138795] N84-22539
More precise numerical simulation of transonic flow through passages in turbomachines N84-22788
Linear multistep methods with minimized truncation error for periodic initial value problems [MC-NW-157/83] N84-23195
A posteriori error analysis in L sub p norms for the finite element method [CTH-MATH-1983-15] N84-23198

A new eigenfunction expansion and its application to waveguide acoustics
[AD-A138946] N84-23236
BRAIN
New techniques for measuring single event related brain potentials
[AD-A138694] N84-23107
BRANCHING (MATHEMATICS)
Bifurcation of map resonance 1 : 4
[MC-TW-245/83] N84-23204
Local bifurcation of a logistic delay map
[MC-TW-246/83] N84-23205
BRAZIL
Estimating monthly rainfall from geostationary satellite imagery over Amazonia, Brazil N84-23089
BRAZING
Development of high strength braze joints in beryllium
[DE84-007243] N84-22964
BRIDGES (STRUCTURES)
Intramolecular electron transfer at metal surfaces. 2: Comparisons of ligand-bridged CR(3) reduction kinetics at silver versus mercury electrodes
[AD-A139047] N84-22720
BRIGHTNESS TEMPERATURE
A microwave systems approach to measuring root zone soil moisture
[E84-10114] N84-23007
BRINES
Generating capacity of the Heber geothermal field, California
[DE84-006883] N84-23030
BROADBAND
Local network wideband interconnection alternatives
[AD-A138604] N84-22868
Analysis of propagation conditions at 20 and 30 GHz in Europe
[CRPE-NT-122] N84-22880
BROADCASTING
The CARFAX road traffic information system
[BBC-RD-1984/1] N84-22818
BRONZES
Ferroelectric tungsten bronze bulk crystals and epitaxial thin films for electro-optic device applications
[AD-A138693] N84-23278
BROWNIAN MOVEMENTS
Geometric bounds on the Ornstein-Uhlenbeck velocity process
[CTH-MATH-1983-17] N84-23212
BUBBLES
ALESEP: A computer program for the analysis of airfoil leading edge separation bubbles
[NASA-CR-172310] N84-22537
BUDGETS
Use of economic mechanisms in managing scientific and technical progress N84-23389
Computer developments at Institute of Automation and Electrometry described N84-23390
BURNING RATE
An optical surface tracking device which determines a solid propellant's burning rate N84-22636
Insitu measurement of burning rate N84-22639
Measurement of solid propellant burning rates employing microwave techniques N84-22640
Dependence of burning rate of AP-polymer sandwiches on thickness of the binder laminae N84-22653
Effect of fabrication techniques on consolidated charge burning N84-22668
Modeling effects of composition on the burn rates of nitrate ester-based energetic binders N84-22685
BURNOUT
Acoustic and photoelectric burnout detection of T-burner grains N84-22650
Latchup window tests
[AD-A138660] N84-22894
BURSTS
Central burst of simultaneously rotating and gravitating body N84-22783
The study of the physics of cometary nuclei
[NASA-CR-173519] N84-23543
BUTTES
East Butte: A volcanic dome of the Eastern Snake River Plain, Idaho N84-23475
BYPASSES
Method of making an ion beam sputter-etched ventricular catheter for hydrocephalus shunt
[NASA-CASE-LEW-13107-2] N84-23095

C

CABLES (ROPES)
Linear dynamics of cables and chains N84-22978
CADMIUM SULFIDES
Characterization of single crystal Cu/sub 2S/CdS heterojunctions by hing resolution electron microscopy
[DE84-006761] N84-23287
CADMIUM TELLURIDES
X-ray photoelectron and Auger electron spectroscopic study of the CdTe surface resulting from various surface pretreatments: Correlations of photoelectrochemical and capacitance-potential behavior with surface chemical composition
[AD-A138601] N84-22714
CALCULUS
Exponential calculus of microdifferential operators of infinite order, part 1 N84-23181
CALDERAS
Volcanic forms in the Kane Patera region, Io N84-23437
Classification of volcanoes of the Kane Patera Quadrangle of Io: Proportions of lava flows and pyroclastic flows N84-23477
Calderas in the solar system N84-23485
CALIBRATING
Civil turbofan propulsion system integration studies using powered testing techniques at ARA, Bedford
[ARA-MEMO-246] N84-22561
Method and apparatus for precision control of radiometer
[NASA-CASE-NPO-15398-1] N84-22931
An absolute calibration method for electron cyclotron emission spectrometers
[REPT-83-149] N84-22941
Spectroradiometric calibration of the Thematic Mapper and multispectral scanner system
[E84-10098] N84-23000
Sensor radiance for a midlatitude atmospheric model N84-23001
In-flight absolute radiometric calibration of the Thematic Mapper — White Sands, New Mexico N84-23002
CALIFORNIA
Generating capacity of the Heber geothermal field, California
[DE84-006883] N84-23030
Neotectonics of the north frontal fault system of the San Bernardino Mountains, southern California: Cajon Pass to Lucerne Valley N84-23061
CALLISTO
Geologic investigations of outer planets satellites
[NASA-CR-173497] N84-23544
CANTILEVER BEAMS
Wave attenuation in periodic structures
[AD-A138924] N84-22984
CASE (Computer-Aided Structural Engineering) study of 6 major general-purpose finite element programs
[AD-A139065] N84-22986
CANYONS
A tectonic geomorphological classification of the walls of Valles Marineris N84-23518
CAPACITANCE SWITCHES
Controller for the electro-optical shutter of a dual pulse laser N84-22776
CAPACITORS
High voltage-high power components for large space power distribution systems
[NASA-TM-83648] N84-22615
CARBIDES
Absorbable-susceptor joining of ceramic surfaces
[NASA-CASE-NPO-15640-1] N84-22748
CARBON
Solid carbon oxidation and radiation in exhaust plumes N84-22623
Diamondlike flakes
[NASA-CASE-LEW-13837-2] N84-22696
CARBON COMPOUNDS
Diamondlike flake composites
[NASA-CASE-LEW-13837-1] N84-22695
CARBON DIOXIDE LASERS
Miniaturized pulsed CO2 laser with sealed electron source N84-22782
CARBON MONOXIDE
Organometallic chemistry of weakly solvated transition metal cations
[DE84-006987] N84-22726
CARBORANE
Carboranylmethylene-substituted phosphazenes and polymers thereof
[NASA-CASE-ARC-11370-1] N84-22750
CARIBBEAN SEA
Application of Magsat lithospheric modeling in South America. Part 1: Processing and interpretation of magnetic and gravity anomaly data
[E84-10115] N84-23008
CARTESIAN COORDINATES
Transient three-dimensional predictions of turbulent flows in cylindrical and cartesian coordinate systems N84-22927
CASCADE FLOW
Analysis of inviscid and viscous flows in cascades with an explicit multiple-grid algorithm
[NASA-TM-83636] N84-22527
Redesign and cascade tests of a supercritical controlled diffusion stator blade-section
[NASA-TM-83635] N84-22533
Calculation of apparent masses in blade ring N84-22793
CASING
Dual clearance squeeze film damper
[NASA-CASE-LEW-13506-1] N84-22562
CASTING
Chemical properties and film casting of radiation grafted ion-containing polymers
[AD-A138551] N84-22754
CATALOGS (PUBLICATIONS)
Satellite Services Catalog: Tools and equipment
[NASA-TM-85627] N84-22597
Documentation for the machine-readable version of the SAO-HD-GC-DM cross index version 1983
[NASA-TM-85570] N84-23418
CATALYSTS
Physical and chemical investigations on real catalyst surfaces
[BMFT-FB-T-83-273] N84-22729
CATHETERIZATION
Method of making an ion beam sputter-etched ventricular catheter for hydrocephalus shunt
[NASA-CASE-LEW-13107-2] N84-23095
CATHODES
Cathode degradation and erosion in high pressure arc discharges
[NASA-TM-83638] N84-22631
CATHODIC COATINGS
Cathode degradation and erosion in high pressure arc discharges
[NASA-TM-83638] N84-22631
CATIONS
Organometallic chemistry of weakly solvated transition metal cations
[DE84-006987] N84-22726
CDC COMPUTERS
Biaxial orientation and mechanical properties of amorphous polymers N84-22965
NASTEK: Interactive display of NASTRAN-generated plots
[AD-A138831] N84-22983
CEILINGS (METEOROLOGY)
AWOS (Automatic Weather Observing System) sensor evaluation. Transmissometer, forward-scatter meter and lidar ceilometer
[AD-A138743] N84-23074
CELESTIAL BODIES
Documentation for the machine-readable version of the Smithsonian Astrophysical Observatory Star catalogue (SAO) version 1984
[NASA-TM-85574] N84-23419
CELESTIAL MECHANICS
Cometary nucleus and active regions N84-23450
CENTIMETER WAVES
Quenchings and outbursts of extragalactic radio sources: Nine years of 3.3-mm measurements and comparisons with centimeter-wave variations
[AD-A138233] N84-23550
CENTRAL PROCESSING UNITS
A high speed processor for binary images
[AD-A138908] N84-23125
Comparison of processor arrays with pipeline processors for image processing
[NLR-MP-83011-U] N84-23165
CERAMICS
Absorbable-susceptor joining of ceramic surfaces
[NASA-CASE-NPO-15640 1] N84-22748
Ceramic-to-metal bonding for pressure transducers
[NASA-CR-173500] N84-22753
High temperature failure mechanisms in ceramic polycrystals
[DE84-006641] N84-22764
Method of fabricating an abradable gas path seal
[NASA-CASE-LEW-13269-2] N84-22957
West Europe report: Science and technology
[JPRS-WST-84-011] N84-23224
Qualities of SEP ceramic-ceramic Cerasep composites N84-23225
CEREBROSPINAL FLUID
Method of making an ion beam sputter-etched ventricular catheter for hydrocephalus shunt
[NASA-CASE-LEW-13107-2] N84-23095
CERTIFICATION
Post-test data report for the space shuttle full-scale AFRSI sequence of environments test (OS-305-1 to -5) in the NASA/Ames Research Center 11x11-foot wind tunnel
[NASA-CR-167684] N84-22603
Apparatus for certification of angular-displacement transducers N84-22806

CHALCOGENIDES
Photoelectrochemical cells including chalcogenophosphate photoelectrodes
[NASA-CASE-LAR-12958-1] N84-23019

CHANNEL FLOW
Multicolor printing plate joining
[NASA-CASE-LEW-13598-1] N84-22930

CHARACTERIZATION
Hereditary subdirect irreducibility in graphs
[MC-ZW-193/83] N84-23221

CHARGE COUPLED DEVICES
Signal processing circuit development
[AD-A138648] N84-22870
Programmable scan/read circuitry for charge coupled device imaging detectors — spacecraft attitude control and star trackers
[NASA-CASE-NPO-15345-1] N84-23247

CHARGE EXCHANGE
Formation of negative ions by charge transfer: He(-) to Cl(-)
[DE84-005718] N84-23243

CHARGED PARTICLES
The beam-density effect on energy loss of a relativistic charged particle beam
[AD-A139051] N84-23241

CHEMICAL ANALYSIS
Physical and chemical investigations on real catalyst surfaces
[BMFT-FB-T-83-273] N84-22729
Geologic investigations of outer planets satellites
[NASA-CR-173497] N84-23544

CHEMICAL BONDS
Chemical approach for controlling nadimide cure temperature and rate
[NASA-CASE-LEW-13770-3] N84-22698
Chemical approach for controlling nadimide cure temperature and rate
[NASA-CASE-LEW-13770-4] N84-22699
Chemical approach for controlling nadimide cure temperature and rate
[NASA-CASE-LEW-13770-5] N84-22700
Chemical approach for controlling nadimide cure temperature and rate
[NASA-CASE-LEW-13770-6] N84-22701
Effect of interfacial bonding on the strength of adhesion of elastomers. 3: Interlinking by molecular entanglements
[AD-A138760] N84-22757

CHEMICAL COMPOSITION
Surface-enhanced Raman spectroscopy of electrochemically characterized interfaces. Relations between Raman scattering intensity and surface coverage for simple anionic adsorbates
[AD-A139054] N84-22721
A method for evaluating the surface concentrations of 2 like-charged ions simultaneously adsorbed at an electrode-solution interface
[AD-A139074] N84-22724
Weld penetration variations
[DE84-007915] N84-22963

CHEMICAL LASERS
Bibliography of Soviet Laser Developments, Number 63, January-February 1983
[AD-A138742] N84-22948

CHEMICAL PROPERTIES
MMH-nitrate and plume deposits from NTO/MMH engines N84-22620
Chemical properties and film casting of radiation grafted ion-containing polymers
[AD-A138551] N84-22754

CHEMICAL PROPULSION
A review of in situ propellant production techniques for solar system exploration
[NASA-CR-173494] N84-22595

CHEMICAL REACTIONS
Three-dimensional, primitive-variable model for solid-fuel ramjet combustion N84-22688
The influence of specific reactant-solvent interactions on intrinsic activation entropies for outer-sphere electron transfer reactions
[AD-A139081] N84-22725
The calculation of the heat transfer associated with the injection of methane gas at the stagnation point of the dissociated boundary layer of the laminar air flow
[AD-A139063] N84-22918

CHEMICAL REACTORS
Characterization of zirconium alloy oxidation films by alternating current impedence
[DE84-006225] N84-22766

CHESAPEAKE BAY (US)
The biochemistry and physiology of bacterial adhesion to surfaces
[AD-A138271] N84-23094

CHIPS (ELECTRONICS)
The development and fabrication of an implantable, multiplexed, semiconductor multielectrode array
[AD-A138788] N84-22895

CHIRP SIGNALS
Target super-resolution compensation for coherent airborne radar utilizing spread spectrum waveforms
[AD-A138545] N84-22866

CHLORINE
Observations of major stratospheric chlorine species
[AD-A138646] N84-23045

CHLORINE COMPOUNDS
A shock tube study of chlorine azide decomposition N84-22728
The onset of detonation behind incident shock waves in chlorine azide-argon mixtures N84-22921

CHRONOLOGY
Neotectonics of the north frontal fault system of the San Bernardino Mountains, southern California: Cajon Pass to Lucerne Valley N84-23061
Martian crater size distributions and terrain age N84-23482
Mercury: New identification of ancient multi-ring basins and implications for geologic evolution N84-23483

CIRCUIT BOARDS
An assessment of the reliability of edge connectors — circuit boards
[ERA-82-22] N84-22888

CIRCUITS
Generalized adaptive node concept N84-22833
Programmable scan/read circuitry for charge coupled device imaging detectors — spacecraft attitude control and star trackers
[NASA-CASE-NPO-15345-1] N84-23247

CIRCULATION
Numerical predictions of residence times behind a rearward facing step with transverse injection N84-22687

CIRCUMSOLAR RADIATION
Measurement and analysis of diffuse solar irradiance N84-23546

CIVIL AVIATION
FAA (Federal Aviation Administration) aviation forecasts -Fiscal Years 1984-1995
[AD-A138759] N84-22549

CLASSIFICATIONS
Classification of volcanoes of the Kane Patera Quadrangle of Io: Proportions of lava flows and pyroclastic flows N84-23477

CLEARANCES
Oxidizing seal for a turbine tip gas path
[NASA-CASE-LEW-14053-1] N84-22563

CLIFFS
Wind erosion and dune formation on high frozen bluffs N84-23493
Scarp development in the Valles Marineris N84-23515

CLIMATE
Freezing of Martian streams under climatic conditions N84-23498

CLIMATOLOGY
Martian paleoclimate N84-23427

CLIMBING FLIGHT
Post-test data report for the space shuttle full-scale AFRSI sequence of environments test (OS-305-1 to -5) in the NASA/Ames Research Center 11x11-foot wind tunnel
[NASA-CR-167684] N84-22603

CLOCKS
Distributed elections in an Archimedean ring of processors (preliminary version)
[MC-IW-243/83] N84-23202

CLUMPS
On systems with spectral cluster points and their relation to H sup p spaces
[RR-235] N84-23222

CMOS
Testability of VLSI (Very Large Scale Integration) leakage faults in CMOS (Complementary Metal Oxide Semiconductor)
[AD-A138978] N84-23281

COAL
Three-color pyrometer for burning particle temperature measurement N84-22635
Supercritical solvent coal extraction
[NASA-CASE-NPO-15210-1] N84-22709

COALESCING
An analysis of shock coalescence including three-dimensional effects with application to sonic boom extrapolation
[NASA-TP-2214] N84-22906

COATINGS
Diamondlike flake composites
[NASA-CASE-LEW-13837-1] N84-22695

COBALT
Redox thermodynamics of surface-bound reactants. Illustrative behavior of Cobalt(3)/(2) macrobicyclic cage complexes
[AD-A139058] N84-22723

CODING
CONTAM 3 plus improved CONTAM 3 usability N84-22822
Microwave curing of composites N84-22708
Atmospheric correction study/atmospheric model optimization
[INPE-2989-RPE/448] N84-23040
Characteristics of a prototype experiment N84-23140
Structural coverage of functional testing N84-23141
Adaptive hybrid picture coding
[AD-A138876] N84-23184
The early roots of Babylonian mathematics. Part 3: Three remarkable texts from Elba
[CTH-MATH-198314-PT-3] N84-23197

COEFFICIENTS
Nonlinear least-squares fitting of first-order rate coefficients comparison between the Gauss-Seidel method and Swain's kore program
[AD-A139080] N84-23157

COGNITION
Research on cognitive collaboration between persons and computers
[AD-P002692] N84-22853

COHERENCE
Coherence study of geomagnetic fluctuations in frequency range .04 - 0.6 HZ between remote land sites
[AD-A138542] N84-23042

COHERENT RADAR
Target super-resolution compensation for coherent airborne radar utilizing spread spectrum waveforms
[AD-A138545] N84-22866

COLD FLOW TESTS
Fluid-dynamically coupled solid propellant combustion instability - cold flow simulation N84-22644
Direct measurement of high frequency solid propellant response functions N84-22649

COLD WORKING
The application of cold worked holes (in aircraft structures)
[NLR-TR-81120-U] N84-22990

COLLISION AVOIDANCE
System safety study of minimum TCAS II (Traffic Alert and Collision Avoidance System)
[AD-A138674] N84-22548

COLLISIONAL PLASMAS
Long wavelength limit of interchange instabilities
[AD-A138943] N84-23047

COLLOIDING
Properties of simulated comet mantle N84-23452

COLOR
Yellow ophthalmic filters in the visual acquisition of aircraft
[AD-A138536] N84-23097
Dust streaks on Mars: Colors and photometry N84-23489

COLOR CODING
LANDSAT 4 investigations of Thematic Mapper and multispectral scanner applications — Death Valley, California; Silver Bell Copper Mine, Arizona, and Dulles Airport near Washington, D.C.
[E84-10100] N84-23003

COLUMNS (PROCESS ENGINEERING)
Analysis of the transfer function model of tray-type binary distillation columns with liquid hydraulic delay
[RR-234] N84-22816

COMBAT
Educational aids in aircraft combat survivability
[AD-A139090] N84-22556
A formulation and analysis of combat games
[NASA-TM-85927] N84-22585
A man-machine interface concept for a state-of-art, shipboard, command/control console
[AD-P002894] N84-22854

COMBUSTION
Combustion thermodynamics of some boron-nitrogen-hydrogen compounds N84-22684
Three-dimensional, primitive-variable model for solid-fuel ramjet combustion N84-22688
Detailed flow measurements in fuel-rich, particle-laden plumes N84-22690
Combustion performance of a vitiated air heater for a freejet test facility N84-22691
Very low thrust gaseous oxygen-hydrogen rocket engine ignition technology N84-22692
Three-dimensional, primitive-variable model for solid-fuel ramjet combustion
[AD-A138756] N84-22715

COMBUSTION CHAMBERS
Preliminary investigation of a two-zone swirl flow combustor
[NASA-TM-83637] N84-22565

Experimental investigation of the low NO/sub x vortex airblast annular combustor
[NASA-TM-83615] N84-22567
The design and development of a low emissions Tranaply combustor for the civil Spey engine
[PNR-90196] N84-22582
La Recherche Aerospatiale, Bimonthly bulletin, number 1983-4, 215/July-August
[ESA-TT-823] N84-22589
Particle sizing in a fuel rich airbreathing engine combustor N84-22634
Investigation of combustion characteristics of a high chamber pressure rocket motor N84-22693
Alternate fuels combustion research
[AD-A136575] N84-22769
Aerodynamic effect of combustor inlet-air pressure on fuel jet atomization
[NASA-TM-83611] N84-22910
Infrared temperature measurements in combustion systems
[PNR-90170] N84-22942
Heat pipes to reduce engine exhaust emissions
[NASA-CASE-LEW-12590-1] N84-22958

COMBUSTION EFFICIENCY
Effect of oscillations upon velocity distributions in simulated solid propellant flow environments N84-22646
Three-dimensional vorticity procedure interactions in combustion instability analysis of solid propellant rocket motors N84-22647
Tangential mode instability in double-base solid rocket motors: A case study N84-22652
Aerodynamic effect of combustor inlet-air pressure on fuel jet atomization
[NASA-TM-83611] N84-22910
Heat pipes to reduce engine exhaust emissions
[NASA-CASE-LEW-12590-1] N84-22958

COMBUSTION PHYSICS
La Recherche Aerospatiale, Bimonthly bulletin, number 1983-4, 215/July-August
[ESA-TT-823] N84-22589
Advanced diagnostics for reacting flows N84-22637
Deuterium isotope effects in HMX thermochemical mechanisms: Decomposition, deflagration, and combustion N84-22680

COMBUSTION STABILITY
Direct measurement of high frequency solid propellant response functions N84-22649

COMBUSTION TEMPERATURE
Investigation of organic oxidizers for high performance low flame temperature gas generator applications N84-22676

COMET NUCLEI
Comet nucleus sample return mission
[NASA-CR-173501] N84-22592
Cometary nucleus and active regions N84-23450
The study of the physics of cometary nuclei
[NASA-CR-173519] N84-23543

COMFORT
Cognitive performance change during a 6-hour hike at low temperature in simulated rain, at controlled walking rates
[AD-A136358] N84-23100

COMMAND AND CONTROL
Proceedings of the 6th MIT/ONR (Massachusetts Institute of Technology/Office of Naval Research) Workshop on C3 (Command, Control, and Communications) Systems
[AD-A136614] N84-22835
Doing C2 (Command Control) experiments using war games
[AD-P002875] N84-22836
A comparison of two air defense command and control models
[AD-P002876] N84-22837
Lanchester's equations and game theory
[AD-P002877] N84-22838
Software for explicitly probabilistic mathematics
[AD-P002881] N84-22842
Command decision makers and their modes of interaction
[AD-P002882] N84-22843
The effects of a spatial information format on decision making performance in a C3 (Command, Control, and Communications) probabilistic information integration task
[AD-P002887] N84-22848
Tactical decision aids which quantify judgment
[AD-P002889] N84-22850
A man-machine interface concept for a state-of-art, shipboard, command/control console
[AD-P002894] N84-22854
Multi-sensor fusion, communications and information warfare
[AD-P002895] N84-22855
Optimal file allocation problems for distributed data bases in unreliable computer networks, 2
[AD-P002913] N84-22864
Human factors aspects of C3 systems — command, control, communication (C3I)
[PP-119] N84-23115
Generalized monitoring facility. Users manual. Change 7
[AD-A136533] N84-23151
A concept for mission-oriented planning for system acquisition at the Defense Communications Agency
[AD-P002823] N84-23366

COMMERCIAL AIRCRAFT
Turboprop engine design concepts
[PNR-90161] N84-22576

COMMUNICATING
Strategies and mechanisms for the diffusion of scientific and technical information: A comparative study N84-23406

COMMUNICATION
Exhaust plume induced fluctuations in the index of refraction at optical wavelengths N84-22624
Development of a generalized human-machine interface
[AD-P002868] N84-22849
Transmitting two-level balanced code within the bandwidth of straight binary code-transmission N84-23231

COMMUNICATION EQUIPMENT
A concept for mission-oriented planning for system acquisition at the Defense Communications Agency
[AD-P002823] N84-23366

COMMUNICATION NETWORKS
The CARFAX road traffic information system
[BBC-RD-1984/1] N84-22818
Spread spectrum networks N84-22831
Spread spectrum data networks N84-22832
Distributed estimation in the MIT/LL (Massachusetts Institute of Technology/Lincoln Laboratory) DSN (Distributed Sensor Networks) test-bed
[AD-P002897] N84-22856
Distributed estimation systems
[AD-P002898] N84-22857
Optimal file allocation problems for distributed data bases in unreliable computer networks, 2
[AD-P002913] N84-22864
Local network wideband interconnection alternatives
[AD-A136804] N84-22868
Some analytical aspects of the peakedness concept
[MC-SW-183/83] N84-23217
Paperless solicitation and contracting
[AD-P002749] N84-23296

COMPACTING
Shock consolidation of powders: Theory and experiment
[DE84-007273] N84-22741

COMPARISON
Comparison between measured turbine stage performance and the predicted performance using quasi-3D flow and boundary layer analyses
[NASA-TM-83640] N84-22564
Empirical analysis of a token ring network
[AD-A136005] N84-23164
On 'Before' and 'After' cost comparisons
[AD-P002759] N84-23345

COMPETITION
Competitive procurements: The synergistic linkage among government, industry and academe
[AD-P002773] N84-23320
Competition: An integral part of the acquisition process
[AD-P002774] N84-23321
Increasing spares competition in AFLC (Air Force Logistics Center)
[AD-P002775] N84-23322

COMPOSITE MATERIALS
Pre-stressed thermal protection systems
[NASA-CASE-MSC-20254-1] N84-22601
Diamondlike flake composites
[NASA-CASE-LEW-13697-1] N84-22695
Microwave curing of composites N84-22708
Non-destructive evaluation of composite materials using ultrasound
[NASA-CR-173416] N84-22969
West Europe report: Science and technology
[JPRS-WST-84-011] N84-23224
Qualities of SEP ceramic-ceramic Cerasep composites N84-23225

COMPOSITE PROPELLANTS
Status of ammonium nitrate in propellants and explosives N84-22655
Nitramine propellant ignition under rapid gas loading conditions N84-22677
Multiphase flow analysis of the ballistic performance of an aromatized LOVA propellant mix N84-22679
CARS studies of nitramine LOVA propellant combustion N84-22683

COMPOSITE STRUCTURES
Moisture transport in composites during repair work
[AD-A136658] N84-22703
New theory for thick, composite-material rings
[AD-A136536] N84-22961

COMPRESSIBILITY
Compressibility of colloids. 2: Compressibility studies of tri-block non-ionic polymers in toluene and water solutions
[AD-A136736] N84-22755
Effect of pressure on the mechanical properties of polymers, part 1
[DE84-006311] N84-22765

COMPRESSIBLE FLUIDS
Dynamic stifness of closed gas-static bearing with regulator N84-22774
Improvement of dynamic characteristics of gas-static bearings N84-22775

COMPRESSION LOADS
Elysium Region, Mars: Charactertzation of tectonic features N84-23534

COMPRESSION TESTS
Compressional features in the Tharsis Region of Mars: Orientations and Timing of Deformation N84-23539

COMPRESSIVE STRENGTH
Revision of design values for 7075-T7351 and 7075-T7651 aluminum plate
[AD-A139092] N84-22740

COMPRESSORS
Determination of compressor in-stall characteristics from engine surge transients
[NASA-TM-83639] N84-22566
Aeronautics and Space Engineering Board: Aeronautics Assessment Committee
[NASA-TM-85594] N84-22771

COMPUTATION
Atmospheric turbulence simulation for Shuttle orbiter
[NASA-CR-171013] N84-22602
Balancing of flexible rotors with simultaneous precise determination of influencing factors N84-22606
Transient processes in an inductor system consisting of a flat coil and a multilayer conducting medium
[AD-A139053] N84-23232

COMPUTATIONAL FLUID DYNAMICS
Transonic flow calculations using triangular finite elements N84-22529
Three-dimensional nonequilibrium viscous shock-layer flow over the Space Shuttle orbiter N84-22530
Solid carbon oxidation and radiation in exhaust plumes N84-22623
Separation flow past bodies with fixed separation sites N84-22784
More precise numerical simulation of transonic flow through passages in turbomachines N84-22786
Turbulence modeling
[NASA-TM-85889] N84-22913
The changing scene in computational fluid dynamics
[AD-A139861] N84-22914
The equicontinuous structure relation and extension of functions defined on G-spaces
[MC-ZW-192/83] N84-23194

COMPUTER AIDED DESIGN
Optimization of thermal systems with sensitive optics, electronics, and structures
[NASA-CR-3745] N84-22608
Manufacturing influence of design and its importance to successful automation — aircraft engines
[PNR-90189] N84-22814
State-space structures for the realization of low roundoff noise digital filters N84-22900
CASE (Computer-Aided Structural Engineering) study of 6 major general-purpose finite element programs
[AD-A139065] N84-22986
Design considerations for a 10-kW integrated hydrogen-oxygen regenerative fuel cell system
[NASA-TM-83664] N84-23023
Data compression
[AD-A136541] N84-23124
Corporate DP planning: New approaches and new concerns — data processing (DP)
[PNR-90180] N84-23386
Computer developments at Institute of Automation and Electrometry described N84-23390

COMPUTER AIDED MANUFACTURING
Direct digital control of the electric arc furnace
[RR-233] N84-22811
Manufacturing influence of design and its importance to successful automation — aircraft engines
[PNR-90189] N84-22814
Computer methods for industrial automation and robotics N84-23168
Corporate DP planning: New approaches and new concerns — data processing (DP)
[PNR-90180] N84-23386

Computer developments at Institute of Automation and Electrometry described N84-23390

COMPUTER ASSISTED INSTRUCTION

Alternative knowledge acquisition interface structures [AD-A139019] N84-23109

User manual for driver program [AD-A139028] N84-23156

COMPUTER DESIGN

The design and operational development of self-streamlining 2-dimensional flexible walled test sections [NASA-CR-172328] N84-22534

Proceedings of the Eighth Annual Software Engineering Workshop [NASA-TM-85445] N84-23137

Transformations of software design and code may lead to reduced errors N84-23145

Cleanroom certification model N84-23147

An approach to software baseline generation N84-23149

Thomson semiconductors bipolar IC strategy to 1988 N84-23227

COMPUTER GRAPHICS

NASTEK: Interactive display of NASTRAN-generated plots [AD-A138831] N84-22983

COMPUTER NETWORKS

Optimal file allocation problems for distributed data bases in unreliable computer networks, 2 [AD-P002913] N84-22864

Empirical analysis of a token ring network [AD-A138905] N84-23164

Distributed elections in an Archimedean ring of processors (preliminary version) [MC-IW-243/83] N84-23202

French ONERA acquires U.S. supercomputer for research N84-23226

COMPUTER PROGRAMMING

Reprogrammable onboard mission of IRAS [NLR-MP-83014-U] N84-22600

Current research in the Software Engineering Laboratory (SEL) N84-23138

Structural coverage of functional testing N84-23141

Examining functional acceptance testing with structural coverage metrics N84-23142

Generalized monitoring facility. Users manual. Change 7 [AD-A138533] N84-23151

A survey of three language-independent programming environments [MC-IW-240/83] N84-23160

Order-preserving dynamic hashing schemes for associative searching in data base systems N84-23400

COMPUTER PROGRAMS

Analysis of inviscid and viscous flows in cascades with an explicit multiple-grid algorithm [NASA-TM-83636] N84-22527

The design and operational development of self-streamlining 2-dimensional flexible walled test sections [NASA-CR-172328] N84-22534

ALESEP: A computer program for the analysis of airfoil leading edge separation bubbles [NASA-CR-172310] N84-22537

Three-dimensional nonequilibrium viscous shock-layer flows over complex reentry vehicles N84-22543

Comparison between measured turbine stage performance and the predicted performance using quasi-3D flow and boundary layer analyses [NASA-TM-83640] N84-22564

Atmospheric turbulence simulation for Shuttle orbiter [NASA-CR-171013] N84-22602

Application of the CONTAM 3 computer model to the prediction of heating, forces, and contamination on a communications satellite N84-22621

CONTAM 3 plus improved CONTAM 3 usability N84-22622

Computerized static firing analysis techniques of solid propellant rocket motors N84-22641

Three-dimensional, primitive-variable model for solid-fuel ramjet combustion N84-22688

Microwave curing of composites N84-22708

Computer controlled laser optoacoustic spectroscopy for trace gas analysis N84-22710

Three-dimensional, primitive-variable model for solid-fuel ramjet combustion [AD-A138756] N84-22715

Estimation of local stress intensity in flanged thin-wall shell structures under heavy thermal load N84-22799

Stressed-strained state of flanged shells under heavy thermal load beyond elastic limit N84-22800

Balancing of flexible rotors with simultaneous precise determination of influencing factors N84-22808

Software for explicitly probabilistic mathematics [AD-P002881] N84-22842

State-space structures for the realization of low roundoff noise digital filters N84-22900

Parametric and nonparametric Fast Kalman echo cancellation N84-22901

Non-destructive evaluation of composite materials using ultrasound [NASA-CR-173416] N84-22969

Nonlinear/transient rotor dynamics analysis N84-22977

Linear dynamics of cables and chains N84-22978

Method of initial functions for thick shells N84-22996

Development of a 3-D microscale topography system [AD-A138809] N84-23013

Incorporation of remotely sensed soil moisture data into a hydrologic runoff model N84-23017

An approach to control the evolution of software systems N84-23127

On the generation and use of quantitative criteria for assessing software maintenance quality N84-23128

A computer program for the evaluation of cubic splines [BAE-BT-11729] N84-23131

A general purpose guidance simulation program: Software definition [BAE-BT-13122] N84-23132

Proceedings of the Eighth Annual Software Engineering Workshop [NASA-TM-85445] N84-23137

Transformations of software design and code may lead to reduced errors N84-23145

Cleanroom certification model N84-23147

An approach to software baseline generation N84-23149

Managers handbook for software development [NASA-TM-85604] N84-23150

Documentation for software maintenance [AD-A138663] N84-23152

Nonlinear least-squares fitting of first-order rate coefficients comparison between the Gauss-Seidel method and Swain's kore program [AD-A139080] N84-23157

The representation and synthesis of design specifications for distributed software systems N84-23163

Computer methods for industrial automation and robotics N84-23168

Acoustic environmental accuracy requirements for response determination [NASA-CR-171003] N84-23234

Office automation in the acquisition environment [AD-P002747] N84-23294

A cost based acquisition planning model utilizing expert system concepts [AD-P002783] N84-23330

Computer Generated Acquisition Document System (CGADS) [AD-P002784] N84-23331

Employment changes resulting from the award of contracts in labor surplus areas [AD-P002834] N84-23379

Computer developments at Institute of Automation and Electrometry described N84-23390

USSR report: Science and technology policy [JPRS-UST-84-007] N84-23391

Martian paleoclimate N84-23427

MM-wavelength measurements of CO in the atmosphere of Mars and SO2 in the atmosphere of Venus N84-23429

Characterization of surficial geologic units on Venus from Pioneer Venus radar data: A progress report N84-23454

COMPUTER SYSTEMS DESIGN

Numeric keyboard layout and computer menu selection [BAE-BT-11969] N84-23116

The representation and synthesis of design specifications for distributed software systems N84-23163

Computer and database location in designing distributed computer systems N84-23399

COMPUTER SYSTEMS PERFORMANCE

An approach to control the evolution of software systems N84-23127

West Europe report: Science and technology [JPRS-WST-84-011] N84-23224

French ONERA acquires U.S. supercomputer for research N84-23226

Computer and database location in designing distributed computer systems N84-23399

Order-preserving dynamic hashing schemes for associative searching in data base systems N84-23400

COMPUTER SYSTEMS PROGRAMS

Reprogrammable onboard mission of IRAS [NLR-MP-83014-U] N84-22600

A general purpose guidance simulation program: Software definition [BAE-BT-13122] N84-23132

Glossary of Software Engineering Laboratory terms [NASA-TM-85606] N84-23135

COMPUTER TECHNIQUES

Computation of radiation in stratified media by Fast Fourier Transform (FFT) [AD-A138647] N84-22869

60 GHz gyrotron development program [DE84-006806] N84-22899

Development of a 3-D microscale topography system [AD-A138809] N84-23013

Coherence study of geomagnetic fluctuations in frequency range .04 - 0.6 HZ between remote land sites [AD-A138542] N84-23042

The use of a small digital computer for on-line behavioral experiments [AD-A138975] N84-23126

Ordered address binary trees: A technique for the optimization of access to trees on disk [INPE-2916-PRE/428] N84-23133

User manual for driver program [AD-A139028] N84-23156

Empirical analysis of a token ring network [AD-A138905] N84-23164

Computer methods for industrial automation and robotics N84-23168

Statistics and operations research in Europe--1983 [AD-A138953] N84-23215

Paperless solicitation and contracting [AD-P002749] N84-23296

Consolidation of DOD bidder's mailing list application [AD-P002752] N84-23299

Expert systems for price analysis: A feasibility study [AD-P002795] N84-23341

An intelligent manual for price analysis [AD-P002796] N84-23344

Central Demand Data Base (CDDB) End Item Code (EIC) [AD-P002807] N84-23353

Employment changes resulting from the award of contracts in labor surplus areas [AD-P002834] N84-23379

COMPUTER VISION

Machine vision: Three generations of commercial systems [AD-A139037] N84-23123

A high speed processor for binary images [AD-A138908] N84-23125

COMPUTERIZED SIMULATION

The design and operational development of self-streamlining 2-dimensional flexible walled test sections [NASA-CR-172328] N84-22534

A Generalized Escape System Simulation (GESS) computer program: GESS user's guide, version 2, volume 1 [AD-A138844] N84-22545

Model identification and parameter estimation of the power, lift, and drag of light aircraft from a single maneuver N84-22552

Determination of compressor in-stall characteristics from engine surge transients [NASA-TM-83639] N84-22566

La Recherche Aerospatiale, Bimonthly bulletin, number 1983-4, 215/July-August [ESA-TT-823] N84-22589

Dynamics analysis of electrodynamic satellite tethers. Equations of motion and numerical solution algorithms for the tether [NASA-CR-171777] N84-22598

Atmospheric turbulence simulation for Shuttle orbiter [NASA-CR-171013] N84-22602

Computerized static firing analysis techniques of solid propellant rocket motors N84-22641

Estimation of local stress intensity in flanged thin-wall shell structures under heavy thermal load N84-22799

Balancing of flexible rotors with simultaneous precise determination of influencing factors N84-22808

State-space structures for the realization of low roundoff noise digital filters N84-22900

Parametric and nonparametric Fast Kalman echo cancellation N84-22901

Nonlinear/transient rotor dynamics analysis N84-22977

Linear dynamics of cables and chains N84-22978

CASE (Computer-Aided Structural Engineering) study of 6 major general-purpose finite element programs [AD-A139065] N84-22986

Analysis of production data from the Krafla geothermal field, Iceland [DE84-006881] N84-23014

Generating capacity of the Heber geothermal field, California [DE84-006883] N84-23030

Calm ionospheric dynamo. Part 1: Simulations carried out in 1981
[CRPE-NT-112-PT-1] N84-23055
Some comparisons between NVL and oracle-based MRTD approaches — vision models
[BAE-BT-11240] N84-23096
Modeling of inhalation administration of vapors with capacity limited clearance
[AD-A138647] N84-23098
Some observations on relative approaches to visual acquisition modelling
[BAE-BT-11241] N84-23104
Disturbance minimization techniques for linear, time-invariant dynamical systems
[AD-A138915] N84-23185
Bifurcation of map resonance 1 : 4
[MC-TW-245/83] N84-23204
French ONERA acquires U.S. supercomputer for research N84-23226
A dynamic personnel assignment model in the R and D environment
[AD-P002785] N84-23312
An application of the causal-integrative model
[AD-P002786] N84-23333
Employment changes resulting from the award of contracts in labor surplus areas
[AD-P002834] N84-23379
Martian paleoclimate N84-23427
MM-wavelength measurements of CO in the atmosphere of Mars and SO2 in the atmosphere of Venus N84-23429

COMPUTERS
Human decisionmaking in dynamic environments with increasing information processing demands
[AD-P002864] N84-22845
French ONERA acquires U.S. supercomputer for research N84-23226

CONCENTRATION (COMPOSITION)
A method for evaluating the surface concentrations of 2 like-charged ions simultaneously adsorbed at an electrode-solution interface
[AD-A139074] N84-22724
Prediction of atmospheric flow and dispersion over sloping terrain N84-23056

CONCRETE STRUCTURES
Fixity of members embedded in concrete
[AD-A138662] N84-22810

CONDUCTION
Hybrid perturbation/Bubnov-Galerkin technique for nonlinear thermal analysis
[NASA-TP-2145] N84-22907

CONDUCTIVE HEAT TRANSFER
Effect of O2 on double-base propellant ignition N84-22673

CONFERENCES
The 14th JANNAF Plume Technology Meeting, volume 1
[AD-A139654] N84-22619
The 20th JANNAF Combustion Meeting, volume 1
[AD-A139033] N84-22632
Research Trends in Military Communications
[AD-A138229] N84-22821
Proceedings of the 6th MIT/ONR (Massachusetts Institute of Technology/Office of Naval Research) Workshop on C3 (Command, Control, and Communications) Systems
[AD-A138614] N84-22835
The Shock and Vibration Digest, volume 16, no. 3
[AD-A139707] N84-22976
Proceedings of the Eighth Annual Software Engineering Workshop
[NASA-TM-85445] N84-23137
The 1983 International Conference on Fourier Transform Spectroscopy September 1983
[AD-A139014] N84-23258
USSR report: Science and technology policy
[JPRS-UST-84-007] N84-23391

CONICAL BODIES
Thermal characteristics of plasma reactors with cylindrical and conical multijet mixing chambers N84-22788

CONNECTORS
Apparatus for releasably connecting first and second objects in predetermined space relationship
[NASA-CASE-MSC-18969-1] N84-22605

CONSOLES
Device 2E6 (ACMS) Air Combat Maneuvering Simulator instructor console review
[AD-A138972] N84-22587
A man-machine interface concept for a state-of-art, shipboard, command/control console
[AD-P002894] N84-22854

CONSTELLATIONS
Time-resolved spectrophotometry of the nova-like cataclysmic variables RW trianguium and UX Ursa Majoris N84-23408

CONSTRAINTS
Effects of a negative G strap on restraint dynamics and human impact response
[AD-A138642] N84-23121

CONTAMINATION
Priorities for detailed quality assessments of the National Defense Stockpile nonfuel materials
[NMAB-403] N84-23011

CONTINUITY (MATHEMATICS)
The equicontinuous structure relation and extension of functions defined on G-spaces
[MC-ZW-192/83] N84-23194
Poisson integrals of absolutely continuous and other measures
[CTH-MATH-1983-10] N84-23210

CONTINUITY EQUATION
Continuum modeling of stick charge combustion N84-22662

CONTINUOUS WAVE LASERS
Spectrophone stabilized laser with line center offset frequency control
[NASA-CASE-NPO-15516-1] N84-22943

CONTRACT INCENTIVES
Analysis of incentives for productivity-enhancing investment
[AD-P002770] N84-23317
The industrial modernization incentives program: An experimental effort to improve defense contractor productivity
[AD-P002771] N84-23318
Award fee contract provisions as a program management tool
[AD-P002776] N84-23323
Nuclear reactor: On schedule and under cost
[AD-P002790] N84-23337
Improving the effectiveness of award fee contracts for program management support services
[AD-P002827] N84-23372
Contract requirements: A key to controlling DoD acquisition costs
[AD-P002828] N84-23373

CONTRACT MANAGEMENT
Proceedings of the Federal Acquisition Research Symposium with Theme: Government, Industry and Academe: Synergism for Acquisition Improvement
[AD-A137700] N84-23293
Mechanized contract document preparation and abstract system
[AD-P002750] N84-23297
Designing the equitable risk contract
[AD-P002756] N84-23303
Assumption of risk in the R and D environment
[AD-P002757] N84-23304
An analysis of the acquisition strategy decision process along three dimensions of the acquisition improvement program
[AD-P002758] N84-23305
Skunkworks 81 revisited: An update on acquisition strategy
[AD-P002759] N84-23306
Assessing contracting workforce requirements in the matrixed organization
[AD-P002760] N84-23307
Cost accounting standards: A time for government and industry action
[AD-P002767] N84-23314
Government - contractor interaction
[AD-P002768] N84-23315
Needed help for the Federal Acquisition Regulation Council
[AD-P002769] N84-23316
Competitive procurements: The synergistic linkage among government, industry and academe
[AD-P002773] N84-23320
Increasing spares competition in AFLC (Air Force Logistics Center)
[AD-P002775] N84-23322
Award fee contract provisions as a program management tool
[AD-P002776] N84-23323
Nailing down the liability issue once and for all
[AD-P002777] N84-23324
Does the Prompt Payment Act insure timely contract payment?
[AD-P002778] N84-23325
The make or buy decision--its nature and impact
[AD-P002779] N84-23326
Multi-year procurement a 'Team approach'
[AD-P002780] N84-23327
Cost risk and contract type: A normative model
[AD-P002781] N84-23328
Contracting initiative: Best proposal for price
[AD-P002782] N84-23329
A cost based acquisition planning model utilizing expert system concepts
[AD-P002783] N84-23330
An application of the causal-integrative model
[AD-P002786] N84-23333
An automated airframe production cost model
[AD-P002787] N84-23334
Risk analysis: Comparing different contract types
[AD-P002788] N84-23335
Managing for success in defense systems acquisition
[AD-P002789] N84-23336
Nuclear reactor: On schedule and under cost
[AD-P002790] N84-23337
Contractor 'Hungriness' and the relative profitability of DoD business
[AD-P002796] N84-23342
Cost realism: Assuring more realistic contractor cost proposals
[AD-P002800] N84-23348
1982 US Army Materiel Development and Readiness Command (DARCOM) integrated logistic support (ILS) study finding on contracting for ILS
[AD-P002805] N84-23351
Quality at the crossroads
[AD-P002818] N84-23363
Incentives for product quality need contract, cost, production and field co-operation
[AD-P002819] N84-23364
A quality improvement strategy for systems acquisition
[AD-P002820] N84-23365
Engine product performance agreements and the future
[AD-P002821] N84-23366
Improving the effectiveness of award fee contracts for program management support services
[AD-P002827] N84-23372
Contract requirements: A key to controlling DoD acquisition costs
[AD-P002828] N84-23373
Material handling: A target for productivity improvement
[AD-P002829] N84-23374
The impact of factory automation and robotics on the contracting and acquisition processes
[AD-P002830] N84-23375
A survey of contractor productivity measurement practices
[AD-P002831] N84-23376
Strengthening small business participation in Department of Defense extramural research and development
[AD-P002832] N84-23377
Contractor fraud: Government response
[AD-P002833] N84-23378
Employment changes resulting from the award of contracts in labor surplus areas
[AD-P002834] N84-23379
Automating the source selection process
[AD-P002835] N84-23380
Increasing the Contractor/Subcontractor/Vendor bidding lists
[AD-P002836] N84-23381
Selection of multiple sources in weapon systems acquisition
[AD-P002837] N84-23382

CONTRACTORS
Government - contractor interaction
[AD-P002768] N84-23315
Analysis of incentives for productivity-enhancing investment
[AD-P002770] N84-23317
The industrial modernization incentives program: An experimental effort to improve defense contractor productivity
[AD-P002771] N84-23318
Strengthening small business participation in Department of Defense extramural research and development
[AD-P002832] N84-23377
Contractor fraud: Government response
[AD-P002833] N84-23378

CONTRACTS
Mechanized contract document preparation and abstract system
[AD-P002750] N84-23297
Increasing the Contractor/Subcontractor/Vendor bidding lists
[AD-P002836] N84-23381
The Score technique: An analytical approach for assessing the results of manufacturing reviews
[AD-P002838] N84-23383

CONTROL BOARDS
Signal processing circuit development
[AD-A138648] N84-22870

CONTROL EQUIPMENT
System for torque control of unbalanced rotor during passage through resonance N84-22802

CONTROL STABILITY
Robustness and sensitivity of Smith predictor controllers for time-delay systems
[RR-238] N84-22812
Stability and performance deterioration due to modelling errors — plant models
[RR-236] N84-23166
CONTROL THEORY
Application of control theory to large flexible structures using the independent modal-space control method N84-22617
Analysis of the transfer function model of tray-type binary distillation columns with liquid hydraulic delay
[RR-234] N84-22816
The effects of widening time constants and increasing time delay on controller design using approximate models
[RR-239] N84-22817
Time optimal digital control of multi-unit paper web dynamics N84-22991
Stability and performance deterioration due to modelling errors — plant models
[RR-236] N84-23166
Disturbance minimization techniques for linear, time-invariant dynamical systems
[AD-A138915] N84-23185
CONTROLLED ATMOSPHERES
Space station architecture, module, berthing hub, shell assembly, berthing mechanism and utility connection channel
[NASA-CASE-ARC-11505-1] N84-22612
CONTROLLERS
Controller for the electro-optical shutter of a dual pulse laser N84-22776
Robustness and sensitivity of Smith predictor controllers for time-delay systems
[RR-238] N84-22812
CONVECTION
Hybrid perturbation/Bubnov-Galerkin technique for nonlinear thermal analysis
[NASA-TP-2145] N84-22907
CONVECTIVE FLOW
Hydrodynamic theory of convective transport across a dynamically stabilized diffuse boundary layer — plasma flow
[JUEL-1869] N84-23275
CONVECTIVE HEAT TRANSFER
Convective heating of energetic materials N84-22672
CONVERGENCE
The queue G/G/1c: Finite moments of the cycle variables and uniform rates of convergence
[CTH-MATH-1983-24] N84-23218
Linear Volterra convolution equations: Semigroups small solutions and convergence of projection operators
[MC-TW-248/83] N84-23223
CONVOLUTION INTEGRALS
Linear Volterra convolution equations: Semigroups small solutions and convergence of projection operators
[MC-TW-248/83] N84-23223
COOLANTS
Effect of rotation on thermal state of runner blade through effect on heat transfer on coolant side N84-22787
COOLING
Tip cap for a rotor blade
[NASA-CASE-LEW-13654-1] N84-22560
COOLING SYSTEMS
Radiative cooler — spacecraft radiators
[NASA-CASE-NPO-15465-1] N84-22903
Vortex generating flow passage design for increased film-cooling effectiveness and surface coverage — aircraft engine blade cooling
[NASA-TM-83617] N84-22909
COPOLYMERIZATION
Chemical approach for controlling nadimide cure temperature and rate
[NASA-CASE-LEW-13770-3] N84-22698
Chemical approach for controlling nadimide cure temperature and rate
[NASA-CASE-LEW-13770-4] N84-22699
Chemical approach for controlling nadimide cure temperature and rate
[NASA-CASE-LEW-13770-5] N84-22700
Chemical approach for controlling nadimide cure temperature and rate
[NASA-CASE-LEW-13770-6] N84-22701
COPPER SULFIDES
Characterization of single crystal Cu/sub 2S/CdS heterojunctions by hing resolution electron microscopy
[DE84-006761] N84-23287
CORIOLIS EFFECT
Effect of rotation on thermal state of runner blade through effect on heat transfer on coolant side N84-22787
CORNER FLOW
Transonic flow around protruding corner with free streamline N84-22796
CORRELATION
Monitoring software development through dynamic variables N84-23139
Mars apiocostratigraphy N84-23536
CORROSION
Clarification of environmental effects in stress corrosion cracking
[AD-A138561] N84-22737
Characterization of zirconium alloy oxidation films by alternating current impedence
[DE84-006225] N84-22766
CORROSION PREVENTION
Corrosion control through a better understanding of the metallic substrate/organic coating/interface
[AD-A139086] N84-22739
COSMOLOGY
Activities report of the Institute of Astronomy N84-23422
COST ANALYSIS
Engine affordability — aircraft engines
[PNR-90178] N84-22574
Cost estimation model for advanced planetary programs, fourth edition
[NASA-CR-173495] N84-22590
SIRE: An integrated reliability and cost model for the aerospace industry — System Integrated Reliability Evaluator (SIRE)
[PNR-90192] N84-22972
Managers handbook for software development
[NASA-TM-85604] N84-23150
Cost risk trade-offs in timing the production decision
[AD-P002753] N84-23300
Managing program risk: One way to reduce cost growth
[AD-P002754] N84-23301
Risk analysis: Comparing different contract types
[AD-P002788] N84-23335
Nuclear reactor: On schedule and under cost
[AD-P002790] N84-23337
The problem of cost growth
[AD-P002792] N84-23339
Expert systems for price analysis: A feasibility study
[AD-P002795] N84-23341
Independent cost estimates: A case study joint vertical lift aircraft (JVX) program
[AD-P002797] N84-23343
An intelligent manual for price analysis
[AD-P002798] N84-23344
On 'Before' and 'After' cost comparisons
[AD-P002799] N84-23345
Cost realism: Assuring more realistic contractor cost proposals
[AD-P002800] N84-23346
COST EFFECTIVENESS
Cost effectiveness of reliability in the aerospace industry
[PNR-90187] N84-22971
Aircraft noise legislation: An overkill
[PNR-90167] N84-23037
Current research in the Software Engineering Laboratory (SEL) N84-23138
Projecting manpower to attain quality N84-23148
Documentation for software maintenance
[AD-A138663] N84-23152
A comparison of several alternatives to maximum likelihood for the Weibull distribution
[AD-A138721] N84-23208
Consolidation of DOD bidder's mailing list application
[AD-P002752] N84-23299
An analysis of the acquisition strategy decision process along three dimensions of the acquisition improvement program
[AD-P002758] N84-23305
Contract requirements: A key to controlling DoD acquisition costs
[AD-P002828] N84-23373
USSR report: Science and technology policy
[JPRS-UST-84-005] N84-23394
Problems of prompt adoption of new technology discussed N84-23396
COST ESTIMATES
Cost estimation model for advanced planetary programs, fourth edition
[NASA-CR-173495] N84-22590
Advanced planetary studies
[NASA-CR-173496] N84-22591
Manufacturing cost analysis for photovoltaic concentrator tracking structures
[DE84-006318] N84-23032
An approach to software cost estimation
[NASA-TM-85607] N84-23136
Proceedings of the Federal Acquisition Research Symposium with Theme: Government, Industry and Academe: Synergism for Acquisition Improvement
[AD-A137700] N84-23293
Managing program risk: One way to reduce cost growth
[AD-P002754] N84-23301
Assumption of risk in the R and D environment
[AD-P002757] N84-23304
Cost risk and contract type: A normative model
[AD-P002781] N84-23329
A cost based acquisition planning model utilizing expert system concepts
[AD-P002783] N84-23330
An application of the causal-integrative model
[AD-P002786] N84-23333
An automated airframe production cost model
[AD-P002787] N84-23334
Independent cost estimates: A case study joint vertical lift aircraft (JVX) program
[AD-P002797] N84-23343
On 'Before' and 'After' cost comparisons
[AD-P002799] N84-23345
Cost realism: Assuring more realistic contractor cost proposals
[AD-P002800] N84-23346
COST REDUCTION
Engine affordability — aircraft engines
[PNR-90178] N84-22574
Proven design + new technology = reliability + economy — aircraft engines
[PNR-90199] N84-22973
COSTS
Cost accounting standards: A time for government and industry action
[AD-P002787] N84-23314
Contracting initiative: Best proposal for price
[AD-P002782] N84-23329
The problem of cost growth
[AD-P002792] N84-23339
COUPLED MODES
Surface acoustic wave resonators in layered substrates with large electromechanical coupling coefficient N84-23230
COUPLING
Acoustic-to-Seismic coupling over porous ground surfaces
[AD-A138753] N84-23048
Coupling of airborne sound in a sandy soil — containing seismic sensors
[LEOK-TR-1983-09] N84-23238
COUPLINGS
Apparatus for releasably connecting first and second objects in predetermined space relationship
[NASA-CASE-MSC-18969-1] N84-22605
CRACK GEOMETRY
Crack layer theory
[NASA-CR-174634] N84-22980
CRACK INITIATION
Review of the effects of microstructure on fatigue in aluminum alloys
[NASA-TM-83626] N84-22735
Crack layer theory
[NASA-CR-174634] N84-22980
Corrosion and load transfer effects on fatigue of mechanically fastened joints. Fatigue of zero load transfer specimen
[AD-A139042] N84-22985
CRACK PROPAGATION
On the limiting electrode potential in cavities and its role in deciding between SCC (Stress Corrosion Cracking) and HC (Hydrogen Cracking) in metals
[AD-A138585] N84-22713
Review of the effects of microstructure on fatigue in aluminum alloys
[NASA-TM-83626] N84-22735
The fatigue of powder metallurgy alloys
[AD-A138714] N84-22738
High temperature failure mechanisms in ceramic polycrystals
[DE84-006641] N84-22764
Ultrasonic methods to study shadow boundaries of diffracting cracks. Ultrasonic caustics in NDE (Non-Destructive Evaluation)
[AD-A138639] N84-22970
Prediction of fatigue crack-growth patterns and lives in three-dimensional cracked bodies
[NASA-TM-85787] N84-22979
Crack layer theory
[NASA-CR-174634] N84-22980
Corrosion and load transfer effects on fatigue of mechanically fastened joints. Fatigue of zero load transfer specimen
[AD-A139042] N84-22985
Fracture toughness processes
[DE84-007244] N84-22989

CRACKING (FRACTURING)
On the limiting electrode potential in cavities and its role in deciding between SCC (Stress Corrosion Cracking) and HC (Hydrogen Cracking) in metals
[AD-A138585] N84-22713
Crack layer theory
[NASA-CR-174634] N84-22980
CRACKS
Fracture toughness processes
[DE84-007244] N84-22989
CRATERING
Does saturation cratering exist in the solar system? N84-23467
Progressive impact cratering N84-23469
Geologic investigations of outer planets satellites
[NASA-CR-173497] N84-23544
CRATERS
Photometry of icy satellites: How important is multiple scattering in diluting shadows? N84-23438
Morphology of fresh craters on Ganymede and the origin of pedestal craters N84-23466
Ode to gravity: Depth/diameter for fresh craters on Mercury N84-23470
Cratering history of the Saturnian satellites N84-23473
Geomorphic clues to the Martian volatile inventory. 1: Flow ejecta blankets N84-23474
Distribution and properties of small volcanoes in Acidalia Planitia N84-23478
Radar-visible wind streaks in the Altiplano of Bolivia N84-23527
Ancient volcano-tectonic structures of the Olympus Mons Region, Mars N84-23535
CRAY COMPUTERS
Biaxial orientation and mechanical properties of amorphous polymers N84-22965
CRITERIA
On the generation and use of quantitative criteria for assessing software maintenance quality N84-23128
CRITICAL PATH METHOD
Frequency encoded auditory display of the critical tracking task
[NASA-TM-85869] N84-22558
Implementation of an optimal multicommodity network flow algorithm based on gradient projection and a path flow formulation
[AD-A138935] N84-23154
CROSSLINKING
Chemical approach for controlling nadimide cure temperature and rate
[NASA-CASE-LEW-13770-3] N84-22698
Chemical approach for controlling nadimide cure temperature and rate
[NASA-CASE-LEW-13770-4] N84-22699
Chemical approach for controlling nadimide cure temperature and rate
[NASA-CASE-LEW-13770-5] N84-22700
Chemical approach for controlling nadimide cure temperature and rate
[NASA-CASE-LEW-13770-6] N84-22701
Process for preparing perfluorotriazine elastomers and precursors thereof
[NASA-CASE-ARC-11402-1] N84-22744
Ethynyl and substituted ethynyl-terminated polysulfones
[NASA-CASE-LAR-12931-1] N84-22747
Effect of interfacial bonding on the strength of adhesion of elastomers. 3: Interlinking by molecular entanglements
[AD-A138760] N84-22757
CRUDE OIL
Tactical buying decisions for strategic petroleum reserve spot procurements: The tunnel theory
[AD-P002812] N84-23358
CRUSTAL FRACTURES
Venus: The nature of the surface from Venera panoramas N84-23459
Small-scale polygons on Mars N84-23505
CRYOGENICS
Select fiber composites for space applications: A mechanistic assessment
[NASA-TM-83631] N84-22702
CRYSTAL GROWTH
Plasma-initiated laser deposition of polycrystalline and monocrystalline silicon films
[DE84-005527] N84-22953
Ferroelectric tungsten bronze bulk crystals and epitaxial thin films for electro-optic device applications
[AD-A139693] N84-23278
CRYSTAL STRUCTURE
Characterization of single crystal Cu/sub 2S/CdS heterojunctions by hing resolution electron microscopy
[DE84-006761] N84-23287
Geometric rationale for hydrogenated Pd3P/sub 1-x
[DE84-006737] N84-23288
Theoretical predictions for the phase stability of dense binary mixtures N84-23426
CRYSTALLIZATION
High pressure melting and crystallization of Nylon-11
[AD-A138658] N84-22760
CRYSTALLOGRAPHY
Characterization of single crystal Cu/sub 2S/CdS heterojunctions by hing resolution electron microscopy
[DE84-006761] N84-23287
CRYSTALS
High pressure melting and crystallization of Nylon-11
[AD-A138658] N84-22760
Precise measurement of refractive index and absorption coefficient of near millimeter wave and far infrared materials
[AD-A138658] N84-23253
CURING
Chemical approach for controlling nadimide cure temperature and rate
[NASA-CASE-LEW-13770-3] N84-22698
Chemical approach for controlling nadimide cure temperature and rate
[NASA-CASE-LEW-13770-4] N84-22699
Chemical approach for controlling nadimide cure temperature and rate
[NASA-CASE-LEW-13770-5] N84-22700
Chemical approach for controlling nadimide cure temperature and rate
[NASA-CASE-LEW-13770-6] N84-22701
Microwave curing of composites N84-22706
The curing of a bisphenol A type epoxy resin with 1,8 Diamino-P-Menthane
[AD-A138977] N84-22761
CURVATURE
Film cooling on a gas turbine blade near the end wall
[AD-A138794] N84-22569
A universal 3-dimensional wall pressure correction method for closed rectangular subsonic wind tunnel test sections (displacement, downwash, streamline curvature)
[ESA-TT-800] N84-22588
CURVED PANELS
Large deformation behavior of long shallow cylindrical composite panels
[NASA-CR-173286] N84-22975
CUSHIONS
Evaluation of 'Sorbothane' cushioning material
[AD-A139079] N84-22763
CYBERNETICS
An N to the 1.618th power lower bound on the time to simulate one queue or two pushdown stores by one tape
[MC-IW-245/83] N84-23161
CYCLIC LOADS
The cyclic behaviour of a powder Ni-base superalloy — aircraft engines
[PNR-90182] N84-22743
CYCLONES
A study of Western North Pacific tropical storms and typhoons that intensify after recurvature
[AD-A138792] N84-23075
CYCLOTRON RADIATION
An absolute calibration method for electron cyclotron emission spectrometers
[REPT-83-149] N84-22941
CYCLOTRON RESONANCE DEVICES
60 GHz gyrotron development program
[DE84-006606] N84-22899
CYLINDRICAL ANTENNAS
Study and design of a cylindrical lens array antenna for wideband electronic scanning
[AD-A138808] N84-22875
CYLINDRICAL BODIES
Effect of hydromechanical inertia forces on stability of cylindrical hydrodynamic bearing N84-22789
Calculation procedures for variational, Born and exact solutions for electromagnetic scattering from two randomly separated dielectric Rayleigh cylinders
[AD-A138543] N84-22865
Transient three-dimensional predictions of turbulent flows in cylindrical and cartesian coordinate systems N84-22927
Analysis of a fully discrete scheme for the neutron transport in cylindrical geometry
[CTH-MATH-1984-1] N84-23246
CYLINDRICAL CHAMBERS
Thermal characteristics of plasma reactors with cylindrical and conical multijet mixing chambers N84-22788
CYLINDRICAL SHELLS
Study of large viscoplastic strains in cylindrical shells by method of magnetic-pulse loading N84-22798
Estimation of local stress intensity in flanged thin-wall shell structures under heavy thermal load N84-22799
Stressed-strained state of flanged shells under heavy thermal load beyond elastic limit N84-22800
Solving statics problems of thick-walled cylindrical shells with loose contact between layers N84-22805
Large deformation behavior of long shallow cylindrical composite panels
[NASA-CR-173286] N84-22975
Underwater shock-induced responses of submerged cylindrical structures
[AD-A139072] N84-22987
Method of initial functions for thick shells N84-22996
CZOCHRALSKI METHOD
Ferroelectric tungsten bronze bulk crystals and epitaxial thin films for electro-optic device applications
[AD-A139693] N84-23278

D

DAMAGE ASSESSMENT
Crack layer theory
[NASA-CR-174634] N84-22980
DAMPING
Dual clearance squeeze film damper
[NASA-CASE-LEW-13506-1] N84-22562
Constant force friction damper
[NASA-CASE-MSC-20505-1] N84-22611
DATA ACQUISITION
Electro-Magnetic Compatability Test Facility, Bristol
[BAE-BT-10558] N84-22586
An automated system for characterizing laser pulses
[AD-A138580] N84-22945
Coherence study of geomagnetic fluctuations in frequency range .04 - 0.6 HZ between remote land sites
[AD-A138542] N84-23042
Estimating monthly rainfall from geostationary satellite imagery over Amazonia, Brazil N84-23069
The use of a small digital computer for on-line behavioral experiments
[AD-A138975] N84-23126
Monitoring software development through dynamic variables N84-23139
Publication in professional journals in science and engineering: A survey of editorial procedures and opinion
[AD-A138913] N84-23385
Short time-scale surface changes on Io N84-23447
The planet crossing asteroid survey: Progress in the analysis of populations and terrestrial-planet cratering rates N84-23449
Mercury: Topographic and geologic data from Earth-based radar observations N84-23533
DATA BASE MANAGEMENT SYSTEMS
Computer and database location in designing distributed computer systems N84-23399
Order-preserving dynamic hashing schemes for associative searching in data base systems N84-23400
Beyond the data base: Technology for information resource management
[AD-A138840] N84-23402
DATA BASES
Cost estimation model for advanced planetary programs, fourth edition
[NASA-CR-173495] N84-22590
Analysis of spacecraft charging, particle beams and geophysical data bases
[AD-A138632] N84-22616
Optimal file allocation problems for distributed data bases in unreliable computer networks, 2
[AD-P002913] N84-22864
Machine vision: Three generations of commercial systems
[AD-A139037] N84-23123
Software Engineering Laboratory (SEL) data base reporting software user's guide and system description. Volume 1: Introduction and user's guide
[NASA-TM-85606] N84-23129
Software Engineering Laboratory (SEL) data base reporting software user's guide and system description. Volume 2: Program descriptions
[NASA-TM-85609] N84-23130
An approach to software baseline generation N84-23149
Central Demand Data Base (CDDB) End item Code (EIC)
[AD-P002807] N84-23353
Increasing the Contractor/Subcontractor/Vendor bidding lists
[AD-P002836] N84-23381
Computer and database location in designing distributed computer systems N84-23399
Order-preserving dynamic hashing schemes for associative searching in data base systems N84-23400
The planet crossing asteroid survey: Progress in the analysis of populations and terrestrial-planet cratering rates N84-23449
Galilean satellite multispectral data base production N84-23521

DATA COMPRESSION
Compression algorithm for data analysis in a radio link (preparation of PACEM 2 experiment)
[CRPE-NT-121] N84-22861
Image compression: A 2-dimensional run-length coding N84-23162
Adaptive hybrid picture coding
[AD-A138876] N84-23184
Feasibility studies of optical processing of image bandwidth compression schemes
[AD-A138736] N84-23254

DATA LINKS
A model for asynchronous distributed computation
[AD-P002879] N84-22840
Compression algorithm for data analysis in a radio link (preparation of PACEM 2 experiment)
[CRPE-NT-121] N84-22861

DATA MANAGEMENT
Integrated Global Ocean Services System (IGOSS): Guide to the IGOSS data processing and services system
[WMO-623] N84-23089
The microcomputer in the acquisition environment
[AD-P002748] N84-23295
Computer Generated Acquisition Document System (CGADS)
[AD-P002784] N84-23331
Publication in professional journals in science and engineering: A survey of editorial procedures and opinion
[AD-A138913] N84-23385
Order-preserving dynamic hashing schemes for associative searching in data base systems N84-23400

DATA PROCESSING
Study of large viscoplastic strains in cylindrical shells by method of magnetic-pulse loading N84-22798
Human decisionmaking in dynamic environments with increasing information processing demands
[AD-P002884] N84-22845
Ongoing data reduction, theoretical studies and supporting research in magnetospheric physics
[NASA-CR-173419] N84-23039
Integrated Global Ocean Services System (IGOSS): Guide to the IGOSS data processing and services system
[WMO-623] N84-23089
Generalized monitoring facility. Users manual. Change 7
[AD-A138533] N84-23151
West Europe report: Science and technology
[JPRS-WST-84-011] N84-23224
French ONERA acquires U.S. supercomputer for research N84-23226
Office automation in the acquisition environment
[AD-P002747] N84-23294
Corporate DP planning: New approaches and new concerns — data processing (DP)
[PNR-90180] N84-23386
Geology of Maxwell Montes, Venus N84-23460

DATA PROCESSING EQUIPMENT
Mechanized contract document preparation and abstract system
[AD-P002750] N84-23297

DATA REDUCTION
LANDSAT 4 investigations of Thematic Mapper and multispectral scanner applications --- Death Valley, California; Silver Bell Copper Mine, Arizona, and Dulles Airport near Washington, D.C.
[E84-10100] N84-23003
The use of a small digital computer for on-line behavioral experiments
[AD-A138975] N84-23126
Venus: The nature of the surface from Venera panoramas N84-23459
Geology of Maxwell Montes, Venus N84-23460

DATA SAMPLING
Parameterization and approximation methods in feedback theory with applications in high gain, fast sampling and cheap optimal control
[RR-241] N84-23167

DATA SMOOTHING
Stochastic techniques applied to the smoothing treatment of bias and compression of artificial satellite tracking and telemetry data
[INPE-2909-TDL/148] N84-22604

DATA STORAGE
NASTEK: Interactive display of NASTRAN-generated plots
[AD-A138831] N84-22983
Order-preserving dynamic hashing schemes for associative searching in data base systems N84-23400
Documentation for the machine-readable version of a table of Redshifts for Abell clusters (Sarazin, Rood and Struble 1982)
[NASA-TM-85571] N84-23417

DATA SYSTEMS
The representation and synthesis of design specifications for distributed software systems N84-23163

DATA TRANSMISSION
Local network wideband interconnection alternatives
[AD-A138604] N84-22666
Fast evaluation of the numerical error rate in the presence of intersymbolic interference
[CRPE-NT-127] N84-23158
Adaptive hybrid picture coding
[AD-A138876] N84-23184
Strategies and mechanisms for the diffusion of scientific and technical information: A comparative study N84-23406

DECISION MAKING
Information processing and decisionmaking organizations: A mathematical description
[AD-P002878] N84-22839
Software for explicitly probabilistic mathematics
[AD-P002881] N84-22842
Command decision makers and their modes of interaction
[AD-P002882] N84-22843
Information theoretic models of memory in human decisionmaking models
[AD-P002883] N84-22844
Human decisionmaking in dynamic environments with increasing information processing demands
[AD-P002884] N84-22845
Individual differences in military decisionmaking: The classification performance of active sonar operators
[AD-P002885] N84-22846
Decision and display analysis in a simple surveillance problem
[AD-P002886] N84-22847
The effects of a spatial information format on decision making performance in a C3 (Command, Control, and Communications) probabilistic information integration task
[AD-P002887] N84-22848
Tactical decision aids which quantify judgment
[AD-P002889] N84-22850
A knowledge based interactive procedure for planning and decision support under uncertainty and parameter imprecision
[AD-P002890] N84-22851
An evaluation of ARIADNE (alternative ranking interactive aid based on dominance structure information elicitation)
[AD-P002891] N84-22852
Research on cognitive collaboration between persons and computers
[AD-P002892] N84-22853
Multi-sensor fusion, communications and information warfare
[AD-P002895] N84-22855
The design of information structures: Basic allocation strategies for organizations
[AD-P002909] N84-22861
Informational aspects of a class of subjective games of incomplete information
[AD-P002910] N84-22862
Dynamic, hierarchical decision problems
[AD-P002912] N84-22863
Ability and expertise in act generation
[AD-A137973] N84-23110
Problem analysis and definition in act generation
[AD-A137978] N84-23111
Cost risk trade-offs in timing the production decision
[AD-P002753] N84-23300
Managing program risk: One way to reduce cost growth
[AD-P002754] N84-23301
DECISION TECHNOLOGY: The catalyst for acquisition improvement
[AD-P002755] N84-23302
Designing the equitable risk contract
[AD-P002756] N84-23303
Competitive procurements: The synergistic linkage among government, industry and academe
[AD-P002773] N84-23320
The make or buy decision--its nature and impact
[AD-P002779] N84-23326
Computer Aided Source Selection (CASS)
[AD-P002785] N84-23332
An automated airframe production cost model
[AD-P002787] N84-23334
Expert systems for price analysis: A feasibility study
[AD-P002795] N84-23341
Program Manager's Support System (PMSS): An update
[AD-P002825] N84-23370
The Score technique: An analytical approach for assessing the results of manufacturing reviews
[AD-P002838] N84-23383

DECISION THEORY
A formulation and analysis of combat games
[NASA-TM-85927] N84-22585
Problem analysis and definition in act generation
[AD-A137978] N84-23111
A framework for the probabilistic analysis of hierarchial planning systems
[MC-BW-160/83] N84-23218
DECISION TECHNOLOGY: The catalyst for acquisition improvement
[AD-P002755] N84-23302

DECONTAMINATION
Deep level impurities in germanium and silicon: Low temperature passivation or removal techniques
[DE84-006772] N84-23286

DEFECTS
Radiation damage and defect behavior in ion-implanted, lithium counterdoped silicon solar cells
[NASA-TM-83646] N84-22990

DEFENSE INDUSTRY
Proceedings of the Federal Acquisition Research Symposium with Theme: Government, Industry and Academe: Synergism for Acquisition Improvement
[AD-A137700] N84-23293
Large firm efficiency, concentration, and profitability in defense markets
[AD-P002810] N84-23356
Strengthening small business participation in Department of Defense extramural research and development
[AD-P002832] N84-23377
Increasing the Contractor/Subcontractor/Vendor bidding lists
[AD-P002836] N84-23381

DEFENSE PROGRAM
Report of the DOD-University forum working group on engineering and science education
[AD-A138205] N84-23292
Closing the gap between R and D and application in academe to better support government and industry
[AD-P002761] N84-23308
The leader of the Army acquisition workforce
[AD-P002762] N84-23309
Competition: An integral part of the acquisition process
[AD-P002774] N84-23321
Increasing spares competition in AFLC (Air Force Logistics Center)
[AD-P002775] N84-23322
Multi-year procurement a 'Team approach'
[AD-P002780] N84-23327
Managing for success in defense systems acquisition
[AD-P002789] N84-23336
Impact of corporate resource allocation decisions on national security objectives: Disynergism in aerospace industrial resource planning
[AD-P002801] N84-23347
Readiness planning in a peacetime environment
[AD-P002803] N84-23349
Policy initiatives to achieve readiness and support objectives
[AD-P002804] N84-23350
1982 US Army Materiel Development and Readiness Command (DARCOM) integrated logistic support (ILS) study finding on contracting for ILS
[AD-P002805] N84-23351
New initiatives in international programs
[AD-P002813] N84-23359
Rationalization, standardization and interoperability: Protecting US interests in the process
[AD-P002814] N84-23360
Defense systems acquisition review process: A history and evaluation
[AD-P002822] N84-23367

DEFLAGRATION
Asymptotic condensed phase analysis of deflagrating monopropellants with subsurface exothermicity N84-22656
Condensed phase temperature profiles in deflagrating HMX N84-22657
A summary of the mechanisms of delayed detonation N84-22658
Deuterium isotope effects in HMX thermochemical mechanisms: Decomposition, deflagration, and combustion N84-22680
Modeling the self-deflagration of HMX N84-22682

DEFLECTION
A discrete-element analysis for large deflection of thin plates: A combined effect of geometric and material nonlinearities N84-22995

DEFOLIATION
The Pennsylvania defoliation application pilot test
[E84-10111] N84-23004

DEFORMATION
Modes of deformation and failure of Kevlar 49 fibers and composites
[DE84-004162] N84-22706
Biaxial orientation and mechanical properties of amorphous polymers N84-22965
Large deformation behavior of long shallow cylindrical composite panels
[NASA-CR-173286] N84-22975
Effects of transverse loading on the thickness shear resonance frequencies in crystal plates N84-22994
Neotectonics of the north frontal fault system of the San Bernardino Mountains, southern California: Cajon Pass to Lucerne Valley N84-23061
Impact of Upheaval Dome, Utah N84-23465
Compressional features in the Tharsis Region of Mars: Geographic N84-23536
Interpretation of planetary stress systems: Determination of tectonic over-printing in Northwest Wyoming N84-23540

DEGRADATION
Exhaust plume induced fluctuations in the index of refraction at optical wavelengths N84-22624
Cathode degradation and erosion in high pressure arc discharges
[NASA-TM-83638] N84-22631
Hydrolytic degradation of Kevlar 49 fibers
[DE84-004156] N84-22705
Hydrolytic degradation of kapton film
[AD-A139016] N84-22762

DELAY
A summary of the mechanisms of delayed detonation N84-22658
Multi-sensor array time-delay estimation with small phase incoherences
[AD-A138667] N84-23183

DELTA WINGS
Visualisation of the vortex dominated flow around a delta wing-body combination using a water tunnel
[BAE-821/RES/8631] N84-22904

DEMODULATION
Navigation system and method
[NASA-CASE-GSC-12508-1] N84-22546

DENMARK
Glacial and periglacial landforms in Denmark: Scandinavian analogs for Martian features N84-23507

DENSE PLASMAS
Physics of high temperature, dense plasmas
[AD-A138872] N84-23268

DENSITOMETERS
High resolution ultrasonic densitometer
[DE84-003967] N84-22939

DENSITY DISTRIBUTION
Progressive impact cratering N84-23469

DEPLOYMENT
A study of MX environmental management information system (MXEMIS) needs
[AD-A139025] N84-23404

DEPOSITION
Diamondlike flake composites
[NASA-CASE-LEW-13837-1] N84-22695
Electrical, chemical, and microstructural characterization of gettering mechanisms for VLSI (Very Large Scale Integrated Circuits)
[AD-A138662] N84-22893
Plasma-initiated laser deposition of polycrystalline and monocrystalline silicon films
[DE84-005527] N84-22953
Wind streaks on Mars: Comparisons of production models with observations of bright streaks N84-23486
Martian dust storms witnessed by Viking Lander 1 N84-23487
A possible source for the Martian circumpolar dune material N84-23490

DEPOSITS
MMH-nitrate and plume deposits from NTO/MMH engines N84-22620

DEPTH MEASUREMENT
Airborne lidar for oceanography and hydrology (FLOH)
[ESA-TT-799] N84-22955

DESCRIPTIONS
Toward a theory of library and information science N84-23405

DESERTS
Desert pavement study at Amboy, California N84-23492
Salts in the dry valleys of Antartica N84-23510
Multiprocess evolution of landforms in the Kharga Region, Egypt: Applications to Mars N84-23511
Planetary geomorphology field studies: Iceland and Antarctica N84-23514
Pinacate-Gran Desierto Region, Mexico: SIR-A data analysis N84-23526

DESIGN ANALYSIS
Computerized static firing analysis techniques of solid propellant rocket motors N84-22641
60 GHz gyrotron development program
[DE84-006606] N84-22869
The synthesis and validation of experimental VLSI design using decoupled behavioral, structural and physical specifications N84-22902
State space method for optimal design of shock absorbers with floating boundaries N84-22966
A 37.5-kW point design comparison of the nickel-cadmium battery, bipolar nickel-hydrogen battery, and regenerative hydrogen-oxygen fuel cell energy storage subsystems for low Earth orbit
[NASA-TM-83651] N84-23022
Advanced designs for IPV nickel-hydrogen cells
[NASA-TM-83643] N84-23025
The representation and synthesis of design specifications for distributed software systems N84-23163
Design and fabrication of a surface conversion negative ion source and an 80 keV pre-accelerator
[DE84-006753] N84-23269
RFQ development at LBL
[DE84-006762] N84-23271
Wind abrasion on Venus: A means for experimental investigations N84-23455

DESIGN TO COST
Engine affordability — aircraft engines
[PNR-90178] N84-22574

DETECTION
Optimal maneuver detection and estimation in multiobject tracking
[AD-P002899] N84-22858
Detection of dotted forms in a structured visual noise environment
[AD-A138653] N84-23106

DETECTORS
An automated system for characterizing laser pulses
[AD-A138580] N84-22945

DETERIORATION
Priorities for detailed quality assessments of the National Defense Stockpile nonfuel materials
[NMAB-403] N84-23011

DETONATION
A summary of the mechanisms of delayed detonation N84-22658
The onset of detonation behind incident shock waves in chlorine azide-argon mixtures N84-22921

DETONATION WAVES
Discrete charge diagnostics on Pre-DIRECT COURSE
[AD-A139073] N84-22919

DICTIONARIES
Glossary of Software Engineering Laboratory terms
[NASA-TM-85606] N84-23135

DIELECTRIC PROPERTIES
Precise measurement of refractive index and absorption coefficient of near millimeter wave and far infrared materials
[AD-A138656] N84-23253
UV and VUV degradation of very high reflectivity mirrors for use in a storage ring free electron laser
[AD-A138740] N84-23255

DIFFERENCE EQUATIONS
Bifurcation of map resonance 1 : 4
[MC-TW-245/83] N84-23204

DIFFERENTIAL EQUATIONS
Dynamics analysis of electrodynamic satellite tethers. Equations of motion and numerical solution algorithms for the tether
[NASA-CR-171777] N84-22598
Lanchester's equations and game theory
[AD-P002877] N84-22838
Rayleigh-Taylor instability in the presence of a stratified shear layer
[AD-A138544] N84-23043
Littlewood Paley's g function associated with a singular differential operator (0, infinity) N84-23180
Exponential calculus of microdifferential operators of infinite order, part 1 N84-23181
Disturbance minimization techniques for linear, time-invariant dynamical systems
[AD-A138915] N84-23185
Formulas for the L-2 minimal solutions of the Delta Delta bar equation in the unit ball of C sup N
[CTH-MATH-1983-16-PREPRINT] N84-23189

DIFFERENTIATORS
A formulation and analysis of combat games
[NASA-TM-85927] N84-22585

DIFFUSE RADIATION
Measurement and analysis of diffuse solar irradiance N84-23546

DIFFUSION
The effect of diffusion induced lattice stress on the open-circuit voltage in silicon solar cells
[NASA-TM-83667] N84-23027

DIFFUSION FLAMES
Ultraviolet OH emissions in H2-air diffusion flames N84-22629

DIGITAL COMMAND SYSTEMS
Direct digital control of the electric arc furnace
[RR-233] N84-22811

DIGITAL DATA
Registration of TM data to digital elevation models N84-22969
LANDSAT 4 investigations of Thematic Mapper and multispectral scanner applications — Death Valley, California; Silver Bell Copper Mine, Arizona, and Dulles Airport near Washington, D.C.
[E84-10100] N84-23003

DIGITAL FILTERS
State-space structures for the realization of low roundoff noise digital filters N84-22900

DIGITAL SYSTEMS
Ordered address binary trees: A technique for the optimization of access to trees on disk
[INPE-2916-PRE/428] N84-23133

DIGITAL TECHNIQUES
Applications of coding to spread spectrum communications N84-22829
Generalized adaptive node concept N84-22833

DIODES
High voltage-high power components for large space power distribution systems
[NASA-TM-83648] N84-22615

DIPOLE ANTENNAS
New formulas for HED (Horizontal Electric Dipole), HMD (Horizontal Magnetic Dipole), VED (Vertical Electric Dipole), and VMD (Vertical Magnetic Dipole) subsurface-to-subsurface propagation
[AD-A139030] N84-23187
New formulas that extend Norton's farfield elementary dipole equations to the quasi-nearfield range
[AD-A139057] N84-23188

DISCONNECT DEVICES
Space probe/satellite ejection apparatus for spacecraft
[NASA-CASE-MFS-15429-1] N84-22609

DISCONTINUITY
Discharge of ideal gas into vacuum N84-22785
Scattering of an electromagnetic plane wave from a perfectly electrically conducting half-plane in the proximity of planar media discontinuities
[AD-A138968] N84-22876
Ultrasonic methods to study shadow boundaries of diffracting cracks. Ultrasonic caustics in NDE (Non-Destructive Evaluation)
[AD-A138839] N84-22970

DISCRETE FUNCTIONS
Analysis of a fully discrete scheme for the neutron transport in cylindrical geometry
[CTH-MATH-1984-1] N84-23246

DISCRIMINANT ANALYSIS (STATISTICS)
Variable selection in heteroscedastic discriminant analysis
[CSIR-TWISK-263] N84-23171

DISPLACEMENT
A universal 3-dimensional wall pressure correction method for closed rectangular subsonic wind tunnel test sections (displacement, downwash, streamline curvature)
[ESA-TT-800] N84-22586

DISPLACEMENT MEASUREMENT
A high temperature optical displacement measuring system — gas turbine blades
[PNR-90186] N84-23261

DISPLAY DEVICES
Preliminary experience with a stereoscopic video system in a remotely piloted aircraft application
[NASA-TM-84909] N84-22557
Frequency encoded auditory display of the critical tracking task
[NASA-TM-85869] N84-22558
The effects of a spatial information format on decision making performance in a C3 (Command, Control, and Communications) probabilistic information integration task
[AD-P002887] N84-22848
Research on cognitive collaboration between persons and computers
[AD-P002892] N84-22853
A man-machine interface concept for a state-of-art, shipboard, command/control console
[AD-P002894] N84-22854
Development of a 3-D microscale topography system
[AD-A138809] N84-23013
Evaluating multiple coordinated windows for programming workstations N84-23148
Control of dynamic systems based on graphic information N84-23159

DISSIPATION
The Laplacian reqonance and tidal dissipation N84-23434

DISTANCE
New formulas that extend Norton's farfield elementary dipole equations to the quasi-nearfield range [AD-A139057] N84-23188
DISTILLATION EQUIPMENT
Analysis of the transfer function model of tray-type binary distillation columns with liquid hydraulic delay [RR-234] N84-22816
DISTORTION
Data compression [AD-A138541] N84-23124
DISTRIBUTED PARAMETER SYSTEMS
Distributed elections in an Archimedean ring of processors (preliminary version) [MC-IW-243/83] N84-23202
On systems with spectral cluster points and their relation to H sup p spaces [RR-235] N84-23222
DISTRIBUTED PROCESSING
Active control of distributed structures N84-22618
A model for asynchronous distributed computation [AD-P002879] N84-22840
Distributed estimation systems [AD-P002898] N84-22857
The acquisition management information system: Friend or foe? [AD-P002751] N84-23298
DISTRIBUTION (PROPERTY)
Martian crater size distributions and terrain age N84-23462
DISTRIBUTION MOMENTS
On orthogonal polynomials on a half line and the associated kernel polynomials [MC-BW-182/83] N84-23192
DIVISION
The early roots of Babylonian mathematics. Part 3: Three remarkable texts from Elba [CTH-MATH-198314-PT-3] N84-23197
DMSP SATELLITES
Office automation in the acquisition environment [AD-P002747] N84-23294
DOCUMENT STORAGE
Ordered address binary trees: A technique for the optimization of access to trees on disk [INPE-2916-PRE/428] N84-23133
DOCUMENTATION
Generalized monitoring facility. Users manual. Change 7 [AD-A138533] N84-23151
Documentation for the machine-readable version of a supplement to the Bright Star catalogue (Hoffleit, Saladyga and Wlasuk 1983) [NASA-TM-85573] N84-23415
Documentation for the machine-readable version of the general catalogue of 33342 stars for the epoch 1950 (Boss 1937) [NASA-TM-85568] N84-23420
DOCUMENTS
Mechanized contract document preparation and abstract system [AD-P002750] N84-23297
DOMAINS
Toward a theory of library and information science N84-23405
DOMES (GEOLOGY)
Impact of Upheaval Dome, Utah N84-23465
East Butte: A volcanic dome of the Eastern Snake River Plain, Idaho N84-23475
DOMINICAN REPUBLIC
Cenozoic tectonics of the Caribbean: Structural and stratigraphic studies in Jamaica and Hispaniola N84-23062
DOPPLER RADAR
Doppler radar having phase modulation of both transmitted and reflected return signals [NASA-CASE-MSC-18675-1] N84-22820
DOUBLE BASE PROPELLANTS
Effect of O2 on double-base propellant ignition N84-22673
DOUBLE BASE ROCKET PROPELLANTS
Tangential mode instability in double-base solid rocket motors: A case study N84-22652
DOWNWASH
A universal 3-dimensional wall pressure correction method for closed rectangular subsonic wind tunnel test sections (displacement, downwash, streamline curvature) [ESA-TT-800] N84-22588
DRAINAGE
Incorporation of remotely sensed soil moisture data into a hydrologic runoff model N84-23017
Drainage evolution in the debris avalanche deposits near Mount Saint Helens, Washington N84-23496
Quantitative and experimental modelling of sapping networks N84-23500
Planetary geomorphology field studies: Washington and Alaska N84-23501
DRAINAGE PATTERNS
Drainage evolution in the debris avalanche deposits near Mount Saint Helens, Washington N84-23496
Fluvial drainage systems: Margaritifer Sinus and Agyre (NC, NE) quadrangles, Mars N84-23497
DRILLING
Multi-small hole drilling by EDM — electrodischarge machining (EDM) [PNR-90184] N84-22813
A review of advanced manufacturing technology — gas turbine components [PNR-90194] N84-22815
DROP SIZE
Aerodynamic effect of combustor inlet-air pressure on fuel jet atomization [NASA-TM-83611] N84-22910
DRY FRICTION
Plane motion of solid body on rough surface of annular bearing rotating about its axis perpendicular to plane of motion N84-22901
DUNES
A possible source for the Martian circumpolar dune material N84-23490
Wind erosion and dune formation on high frozen bluffs N84-23493
DUST
Cometary nucleus and active regions N84-23450
Wind streaks on Mars: Comparisons of production models with observations of bright streaks N84-23486
Dust streaks on Mars: Colors and photometry N84-23489
A possible source for the Martian circumpolar dune material N84-23490
Velocities of windblown particles in saltation: Venus, Earth, and Mars N84-23491
DUST STORMS
Martian dust storms witnessed by Viking Lander 1 N84-23487
Long range transport of fine grained sediments on Mars: Atmospheric dust loading, as inferred from Viking Lander imaging data N84-23488
DYNAMIC CHARACTERISTICS
Device and method for frictionally testing materials for ignitability [NASA-CASE-MSC-20622-1] N84-22596
DYNAMIC CONTROL
Control of dynamic systems based on graphic information N84-23159
DYNAMIC LOADS
Study of large viscoplastic strains in cylindrical shells by method of magnetic-pulse loading N84-22798
DYNAMIC MODELS
Numerical simulation of the tip vortex off a low-aspect-ratio wing at transonic speed [NASA-TM-85932] N84-22535
CONSERVB: A numerical method to compute soil water content and temperature profiles under a bare surface [E84-10113] N84-23006
Disturbance minimization techniques for linear, time-invariant dynamical systems [AD-A138915] N84-23185
Bifurcation of map resonance 1 : 4 [MC-TW-245/83] N84-23204
Geologic investigations of outer planets satellites [NASA-CR-173497] N84-23544
DYNAMIC RESPONSE
Effect of pressure on the static and dynamic acoustic properties of porous rubber [AD-A138744] N84-22758
CASE (Computer-Aided Structural Engineering) study of 6 major general-purpose finite element programs [AD-A139065] N84-22966
Underwater shock-induced responses of submerged cylindrical structures [AD-A139072] N84-22967
DYNAMIC STRUCTURAL ANALYSIS
Feasibility anlysis of novel technological principles of producing multicomponent mechanisms N84-22773
DYNAMO THEORY
Calm ionospheric dynamo. Part 1: Simulations carried out in 1981 [CRPE-NT-112-PT-1] N84-23055

E

EARTH (PLANET)
Photochemical modeling of the Earth's stratosphere N84-23058
The Corfu landslide: Analog to giant landslides on Mars N84-23513
EARTH CRUST
Use of MAGSAT anomaly data for crustal structure and mineral resources in the US midcontinent [E84-10112] N84-23005
Application of Magsat lithospheric modeling in South America. Part 1: Processing and interpretation of magnetic and gravity anomaly data [E84-10115] N84-23008
EARTH OBSERVATIONS (FROM SPACE)
Radar backscatter modelling N84-23525
Pinacate-Gran Desierto Region, Mexico: SIR-A data analysis N84-23526
EARTH ORBITS
A 37.5-kW point design comparison of the nickel-cadmium battery, bipolar nickel-hydrogen battery, and regenerative hydrogen-oxygen fuel cell energy storage subsystems for low Earth orbit [NASA-TM-83651] N84-23022
Advanced designs for IPV nickel-hydrogen cells [NASA-TM-83643] N84-23025
Teardown analysis of a ten cell bipolar nickel-hydrogen battery [NASA-TM-83618] N84-23026
EARTH RADIATION BUDGET EXPERIMENT
Users guide for ERB 7 MAT (including the first year quality control) [NASA-CR-170514] N84-23134
EARTH SURFACE
Velocities of windblown particles in saltation: Venus, Earth, and Mars N84-23491
Fluvial erosion of impact craters: Earth and Mars N84-23494
ECHO SUPPRESSORS
Parametric and nonparametric Fast Kalman echo cancellation N84-22901
ECONOMIC ANALYSIS
Proceedings of the Federal Acquisition Research Symposium with Theme: Government, Industry and Academe: Synergism for Acquisition Improvement [AD-A137700] N84-23293
Economic production rate study [AD-P002793] N84-23340
Tactical buying decisions for strategic petroleum reserve spot procurements: The tunnel theory [AD-P002812] N84-23358
USSR report: Science and technology policy [JPRS-UST-84-004] N84-23387
Incentives for new production discussed N84-23388
Use of economic mechanisms in managing scientific and technical progress N84-23389
USSR report: Science and technology policy [JPRS-UST-84-007] N84-23391
Technical and economic indicators for industrial technological institutes N84-23392
ECONOMIC IMPACT
Employment changes resulting from the award of contracts in labor surplus areas [AD-P002834] N84-23379
Prerequisites for scientific-technical progress enumerated N84-23395
ECONOMICS
Export trade: Big business for the small entrepreneur [AD-P002811] N84-23357
EDGE DISLOCATIONS
Fracture toughness processes [DE84-007244] N84-22989
EDGES
An assessment of the reliability of edge connectors — circuit boards [ERA-82-22] N84-22888
EDITING
Publication in professional journals in science and engineering: A survey of editorial procedures and opinion [AD-A138913] N84-23385
EDITING ROUTINES (COMPUTERS)
An approach to control the evolution of software systems N84-23127
Evaluating multiple coordinated windows for programming workstations N84-23148
A survey of three language-independent programming environments [MC-IW-240/83] N84-23160
EDUCATION
The Shock and Vibration Digest, volume 16, no. 3 [AD-A139707] N84-22976
Report of the DOD-University forum working group on engineering and science education [AD-A138205] N84-23292
Closing the gap between R and D and application in academe to better support government and industry [AD-P002781] N84-23308
Training requirements for changing times [AD-P002764] N84-23311
Training acquisition personnel through a local college [AD-P002766] N84-23313

EFFICIENCY
Comparison between measured turbine stage performance and the predicted performance using quasi-3D flow and boundary layer analyses
[NASA-TM-83640] N84-22564
Performance and size estimating for wind systems foi MF
[DE84-006980] N84-23039
Large firm efficiency, concentration, and profitability in defense markets
[AD-P002810] N84-23356

EFFUSIVES
Experiments on water/melt explosions, nature of products, and models of dispersal N84-23483
The 19 March 1982 eruption and lahar at Mount Saint Helens: Implications for Martian outflow channels? N84-23495

EGYPT
Multiprocess evolution of landforms in the Kharga Region, Egypt: Applications to Mars N84-23511

EIGENVALUES
Active control of distributed structures N84-22618
A new eigenfunction expansion and its application to waveguide acoustics
[AD-A138946] N84-23236

EJECTA
Cometary nucleus and active regions N84-23450
Morphology of fresh craters on Ganymede and the origin of pedestal craters N84-23466
Geomorphic clues to the Martian volatile inventory. 1: Flow ejecta blankets N84-23474

EJECTION SEATS
A Generalized Escape System Simulation (GESS) computer program: GESS user's guide, version 2, volume 1
[AD-A138844] N84-22545

EJECTORS
Space probe/satellite ejection apparatus for spacecraft
[NASA-CASE-MFS-15429-1] N84-22609

ELASTIC BODIES
Biaxial orientation and mechanical properties of amorphous polymers N84-22965

ELASTIC DEFORMATION
Stressed-strained state of flanged shells under heavy thermal load beyond elastic limit N84-22800
The structure of the Ionian lithosphere N84-23435

ELASTIC PROPERTIES
Effect of pressure on the mechanical properties of polymers, part 1
[DE84-006311] N84-22765
Linear dynamics of cables and chains N84-22978
Method of initial functions for thick shells N84-22990

ELASTIC SHELLS
Automatic elimination of static unbalance of rotor in anisotropic bearings N84-22803

ELASTODYNAMICS
Linear dynamics of cables and chains N84-22978

ELASTOHYDRODYNAMICS
Measurements of elastohydrodynamic film thickness, wear and tempering behavior of high pressure oxygen turbopump bearings
[NASA-CR-171008] N84-22960

ELASTOMERS
Process for preparing perfluorotriazine elastomers and precursors thereof
[NASA-CASE-ARC-11402-1] N84-22744
Effect of interfacial bonding on the strength of adhesion of elastomers. 3: Interlinking by molecular entanglements
[AD-A138760] N84-22757
Micromechanics of fracture in elastomers
[AD-A138783] N84-22758

ELASTOPLASTICITY
Stressed-strained state of flanged shells under heavy thermal load beyond elastic limit N84-22800

ELECTRIC ARCS
Direct digital control of the electric arc furnace
[RR-233] N84-22811

ELECTRIC CURRENT
Fine line electromigration. The effect of crossed thermal gradients
[AD-A138654] N84-23279

ELECTRIC DISCHARGES
Multi-small hole drilling by EDM — electrodischarge machining (EDM)
[PNR-90184] N84-22813

ELECTRIC FIELDS
Electromagnetic radiation and scattering from a system of conducting bodies interconnected by wires N84-22882

ELECTRIC POTENTIAL
On the limiting electrode potential in cavities and its role in deciding between SCC (Stress Corrosion Cracking) and HC (Hydrogen Cracking) in metals
[AD-A138565] N84-22713
Teardown analysis of a ten cell bipolar nickel-hydrogen battery
[NASA-TM-83618] N84-23026
The effect of diffusion induced lattice stress on the open-circuit voltage in silicon solar cells
[NASA-TM-83667] N84-23027

ELECTRIC POWER PLANTS
Industrial and marine engine derivatives: A spin-off from aviation — gas turbine engines
[PNR-90197] N84-22581
Wind and solar powered turbine
[NASA-CASE-NPO-15496-1] N84-23018

ELECTRIC POWER SUPPLIES
High voltage-high power components for large space power distribution systems
[NASA-TM-83648] N84-22615
Wind power generation design considerations
[AD-A138841] N84-23029

ELECTRICAL FAULTS
Power transfer for microwave discharges
[AD-A138868] N84-23267

ELECTRICAL MEASUREMENT
Apparatus for certification of angular-displacement transducers N84-22806
Fast Electrical and Optical Diagnostic Principles and Techniques: A NATO Advanced Study Institute
[AD-A138598] N84-22936

ELECTRICAL PROPERTIES
Dynamics analysis of electrodynamic satellite tethers. Equations of motion and numerical solution algorithms for the tether
[NASA-CR-171777] N84-22598

ELECTRICAL RESISTANCE
Fine line electromigration. The effect of crossed thermal gradients
[AD-A138654] N84-23279

ELECTRICAL RESISTIVITY
Scattering of an electromagnetic plane wave from a perfectly electrically conducting half-plane in the proximity of planar media discontinuities
[AD-A138968] N84-22876
The effect of diffusion induced lattice stress on the open-circuit voltage in silicon solar cells
[NASA-TM-83667] N84-23027
Transient processes in an inductor system consisting of a flat coil and a multilayer conducting medium
[AD-A139053] N84-23232

ELECTRO-OPTICS
Exhaust plume induced fluctuations in the index of refraction at optical wavelengths N84-22624
USSR report: Engineering and equipment
[JPRS-UEQ-84-004] N84-22772
Controller for the electro-optical shutter of a dual pulse laser N84-22776
A high temperature optical displacement measuring system — gas turbine blades
[PNR-90186] N84-23261
Ferroelectric tungsten bronze bulk crystals and epitaxial thin films for electro-optic device applications
[AD-A138693] N84-23278

ELECTROCHEMICAL CELLS
Use of a polyacetylene cathode in primary lithium-thionyl chloride cells
[AD-A138791] N84-22896
Chemically rechargeable battery
[NASA-CASE-NPO-16024-1] N84-23020

ELECTROCHEMISTRY
Electron-transfer kinetics of redox centers anchored to metal surfaces: Weak- versus strong-overlap reaction pathways
[AD-A139043] N84-22718
Intramolecular electron transfer at metal surfaces. 2: Comparisons of ligand-bridged CR(3) reduction kinetics at silver versus mercury electrodes
[AD-A139047] N84-22720
Surface-enhanced Raman spectroscopy of electrochemically characterized interfaces. Relations between Raman scattering intensity and surface coverage for simple anionic adsorbates
[AD-A139054] N84-22721
Utility of surface reaction entropies for examining reactant-solvent interactions at electrochemical interfaces. Ferricinium-ferrocene attached to platinum electrodes
[AD-A139055] N84-22722
Redox thermodynamics of surface-bound reactants. Illustrative behavior of Cobalt(3)/(2) macrobicyclic cage complexes
[AD-A139058] N84-22723
The influence of specific reactant-solvent interactions on intrinsic activation entropies for outer-sphere electron transfer reactions
[AD-A139081] N84-22725
Resistance characterization of nickel sulfide electrodes in LiCl-containing molten salt electrolytes
[DE84-006734] N84-22898
Intramolecular electron transfer at metal surfaces. 3: Influence of bond conjugation on reduction kinetics of Cobalt (3) anchored to metal surfaces via thiophenecarboxylate ligands
[AD-A139066] N84-23242
An experimental estimate of the electron-tunneling distance for some outer-sphere electrochemical reactions
[AD-A139049] N84-23284

ELECTRODES
On the limiting electrode potential in cavities and its role in deciding between SCC (Stress Corrosion Cracking) and HC (Hydrogen Cracking) in metals
[AD-A138565] N84-22713
A method for evaluating the surface concentrations of 2 like-charged ions simultaneously adsorbed at an electrode-solution interface
[AD-A139074] N84-22724
Method of making a light weight battery plaque
[NASA-CASE-LEW-13349-1] N84-22734
The development and fabrication of an implantable, multiplexed, semiconductor multielectrode array
[AD-A138788] N84-22895
Advanced designs for IPV nickel-hydrogen cells
[NASA-TM-83643] N84-23025

ELECTROENCEPHALOGRAPHY
New techniques for measuring single event related brain potentials
[AD-A138694] N84-23107

ELECTROLYSIS
Study of systems and technology for liquid hydrogen production independent of fossil fuels
[NASA-CR-173422] N84-22768

ELECTROMAGNETIC COMPATIBILITY
Electro-Magnetic Compatability Test Facility, Bristol
[BAE-BT-10658] N84-22588

ELECTROMAGNETIC FIELDS
New formulas for HED (Horizontal Electric Dipole), HMD (Horizontal Magnetic Dipole), VED (Vertical Electric Dipole), and VMD (Vertical Magnetic Dipole) subsurface-to-subsurface propagation
[AD-A139030] N84-23157

ELECTROMAGNETIC INTERFERENCE
Enhancement of spread-spectrum systems through adaptive antenna techniques N84-22824

ELECTROMAGNETIC PULSES
Study of large viscoplastic strains in cylindrical shells by method of magnetic-pulse loading N84-22798
An automated system for characterizing laser pulses
[AD-A138580] N84-22945

ELECTROMAGNETIC RADIATION
Computation of radiation in stratified media by Fast Fourier Transform (FFT)
[AD-A138647] N84-22869
Scattering of an electromagnetic plane wave from a perfectly electrically conducting half-plane in the proximity of planar media discontinuities
[AD-A138968] N84-22876

ELECTROMAGNETIC SCATTERING
Measuring roughness of ultrasmooth surfaces by reflectometric method N84-22807
Calculation procedures for variational, Born and exact solutions for electromagnetic scattering from two randomly separated dielectric Rayleigh cylinders
[AD-A138543] N84-22865
Scattering of an electromagnetic plane wave from a perfectly electrically conducting half-plane in the proximity of planar media discontinuities
[AD-A138968] N84-22876
Electromagnetic radiation and scattering from a system of conducting bodies interconnected by wires N84-22882

ELECTROMECHANICAL DEVICES
Satellite Services Catalog: Tools and equipment
[NASA-TM-85627] N84-22597
Two-dimensional scanner apparatus — flaw detector in small flat plates
[NASA-CASE-MFS-25687-1] N84-22928

ELECTROMIGRATION
Fine line electromigration. The effect of crossed thermal gradients
[AD-A138654] N84-23279

ELECTRON ACCELERATORS
Review of free electron laser theory and experiments
[DE84-007232] N84-22954

ELECTRON BEAMS
Experience with development of sealed linear waveguide electron accelerators N84-22780
Miniaturized pulsed CO2 laser with sealed electron source N84-22782
60 GHz gyrotron development program
[DE84-006606] N84-22899

ELECTRON BOMBARDMENT
Diamondlike flake composites
[NASA-CASE-LEW-13637-1] N84-22695

ELECTRON BUNCHING
Anomalous laser induced bunch lengthening on the ACO storage ring free electron laser
[AD-A138814] N84-22949
ELECTRON CYCLOTRON HEATING
Electron Cyclotron Emission (ECE) measurements on the TORTUR 3 Tokamak
[REPT-83-148] N84-23274
Activities report of the Institut fuer Plasmaforschung N84-23276
ELECTRON DENSITY (CONCENTRATION)
The electron density and temperature in the photoionized background gas (N2) surrounding a laser produced plasma
[AD-A138651] N84-23266
ELECTRON MICROSCOPES
Development of a 3-D microscale topography system
[AD-A138809] N84-23013
ELECTRON MICROSCOPY
Modes of deformation and failure of Kevlar 49 fibers and composites
[DE84-004162] N84-22706
Characterization of single crystal Cu/sub 2S/CdS heterojunctions by hing resolution electron microscopy
[DE84-006761] N84-23267
ELECTRON PARAMAGNETIC RESONANCE
Research into the thermal decomposition of selected energetic material candidates (Project order ATL-2-094)
[AD-A138730] N84-22770
ELECTRON TRANSFER
Intramolecular electron transfer at metal surfaces. 1. Relative energetics of some corresponding outer- and inner-sphere pathways involving halide and pseudohalide bridging ligands
[AD-A139021] N84-22716
Electron-transfer kinetics of redox centers anchored to metal surfaces: Weak- versus strong-overlap reaction pathways
[AD-A139043] N84-22718
Intramolecular electron transfer at metal surfaces. 2: Comparisons of ligand-bridged CR(3) reduction kinetics at silver versus mercury electrodes
[AD-A139047] N84-22720
The influence of specific reactant-solvent interactions on intrinsic activation entropies for outer-sphere electron transfer reactions
[AD-A139061] N84-22725
Intramolecular electron transfer at metal surfaces. 3: Influence of bond conjugation on reduction kinetics of Cobalt (3) anchored to metal surfaces via thiophenecarboxylate ligands
[AD-A139066] N84-23242
An experimental estimate of the electron-tunneling distance for some outer-sphere electrochemical reactions
[AD-A139049] N84-23284
ELECTRON TUNNELING
An experimental estimate of the electron-tunneling distance for some outer-sphere electrochemical reactions
[AD-A139049] N84-23284
ELECTRONIC COUNTERMEASURES
Adaptive array combined with spread spectrum in communications N84-22825
Spread spectrum communication in jamming N84-22827
ELECTRONIC EQUIPMENT TESTS
Electro-Magnetic Compatability Test Facility, Bristol
[BAE-BT-10658] N84-22586
Apparatus for certification of angular-displacement transducers N84-22806
Environmental qualification tests, signal conditioning unit, SD802 materials experiment
[AD-A138910] N84-22897
ELECTRONIC PACKAGING
Electronic scanning pressure measuring system and transducer package
[NASA-CASE-ARC-11361-1] N84-22934
ELECTRONIC TRANSDUCERS
Apparatus for certification of angular-displacement transducers N84-22806
Electronic scanning pressure measuring system and transducer package
[NASA-CASE-ARC-11361-1] N84-22934
ELECTRONIC WARFARE
Multi-sensor fusion, communications and information warfare
[AD-P002895] N84-22655
ELECTROPHOTOMETRY
A survey of halo RR Lyrae stars N84-23409
ELEVATION
Study and design of a cylindrical lens array antenna for wideband electronic scanning
[AD-A138808] N84-22875
ELLIPSES
Ultrasonic methods to study shadow boundaries of diffracting cracks. Ultrasonic caustics in NDE (Non-Destructive Evaluation)
[AD-A138839] N84-22970
ELLIPSOIDS
Central burst of simultaneously rotating and gravitating body N84-22783
EMBEDDED COMPUTER SYSTEMS
Adaptive control strategies for computer-controlled manipulators N84-23114
EMBEDDING
Fixity of members embedded in concrete
[AD-A138862] N84-22810
EMISSION
The luminosity function of galaxies in CO-12 N84-23424
EMISSION SPECTRA
Ultraviolet OH emissions in H2-air diffusion flames N84-22629
Utilizing light focusing by gas discharge medium for stabilization of emission power of He-Ne laser at wavelength of 6401 angstroms N84-22779
Time-resolved spectrophotometry of the nova-like cataclysmic variables RW trianguium and UX Ursa Majoris N84-23408
H alpha and TiO band observations of RS CVn stars N84-23410
Far-IR spectroscopy of the galactic center: Neutral and ionized gas in the central 10 pc of the galaxy
[NASA-CR-166510] N84-23411
Infrared astronomy research and high altitude observations
[NASA-CR-173526] N84-23413
Publications resulting from Infrared Astronomy Research and High Altitude Observations
[NASA-CR-173525] N84-23414
Shock waves and mass outflow in the Orion molecular cloud: Observations of far-infrared emission lines of carbon monoxide, hydroxyl and ammonia N84-23423
ENDOTHERMIC REACTIONS
High pressure melting and crystallization of Nylon-11
[AD-A138858] N84-22760
ENERGY CONSUMPTION
Supercritical solvent coal extraction
[NASA-CASE-NPO-15210-1] N84-22709
ENERGY CONVERSION
A review of in situ propellant production techniques for solar system exploration
[NASA-CR-173494] N84-22595
Study of solar array switching power management technology for space power system
[NASA-CR-167890] N84-23021
Untapped midwestern wind energy resource: Nocturnal low-level wind maxima
[DE84-006424] N84-23077
ENERGY CONVERSION EFFICIENCY
Wind power generation design considerations
[AD-A138841] N84-23029
ENERGY DISSIPATION
The beam-density effect on energy loss of a relativistic charged particle beam
[AD-A139051] N84-23241
Energy loss of 24.8-MeV electrons by interacting with thick layers of C, Al, Cu, and Pb
[ETL-836] N84-23277
ENERGY LEVELS
On the rate of energy input in thermal solar flares
[AD-A138345] N84-23548
ENERGY POLICY
Wind energy test field Pellworm: Tests of the plant Bruemmer BW 120S
[GKSS-83-E-42] N84-23035
Magnetic fusion energy research and development
[DE84-007089] N84-23270
ENERGY SPECTRA
Dependence of hydromagnetic energy spectra on interplanetary parameters
[AD-A138745] N84-23209
ENERGY STORAGE
Advanced nickel-hydrogen cell configuration study
[NASA-CR-173417] N84-22889
Design considerations for a 10-kW integrated hydrogen-oxygen regenerative fuel cell system
[NASA-TM-83664] N84-23023
Design of a 1-kWh bipolar nickel hydrogen battery
[NASA-TM-83647] N84-23024
Study of flywheel energy storage for space stations
[NASA-CR-171780] N84-23028
ENERGY TRANSFER
Energetics of the magnetosphere, revised
[NASA-TM-86063] N84-23041
Kerma factors for use in 37-group neutron spectrum calculations
[AD-A139033] N84-23240
ENGINE ANALYZERS
Acoustic emission: A brief introduction to some of its uses in the aero engine industry
[PNR-90172] N84-22571
ENGINE COOLANTS
Vortex generating flow passage design for increased film-cooling effectiveness and surface coverage — aircraft engine blade cooling
[NASA-TM-83617] N84-22909
ENGINE DESIGN
Oxidizing seal for a turbine tip gas path
[NASA-CASE-LEW-14063-1] N84-22563
Preliminary investigation of a two-zone swirl flow combustor
[NASA-TM-83637] N84-22565
Engine affordability — aircraft engines
[PNR-90178] N84-22574
Turboprop engine design concepts
[PNR-90181] N84-22576
The accelerating pace of advancing aero engine technology
[PNR-90191] N84-22577
Helicopter engine technology with particular reference to the Rolls-Royce Gem engine
[PNR-90193] N84-22578
Some themes on Rolls-Royce military engine technology. Part 1: Old and new engines for combat aircraft. Part 2: After-burning technology
[PNR-90195] N84-22579
Fuel efficient engines for large transport — aircraft
[PNR-90196] N84-22580
The design and development of a low emissions Transply combustor for the civil Spey engine
[PNR-90198] N84-22582
Computerized static firing analysis techniques of solid propellant rocket motors N84-22641
Analysis of acoustic chamber pressure oscillations in shuttle high-pressure SRB's N84-22651
Calculation of apparent masses in blade ring N84-22793
Proven design + new technology = reliability + economy — aircraft engines
[PNR-90199] N84-22973
ENGINE FAILURE
Acoustic emission: A brief introduction to some of its uses in the aero engine industry
[PNR-90172] N84-22571
ENGINE INLETS
Experimental investigation of the internal flow field in STOL engine inlets N84-22544
Mixing of swirling flows and behavior of wet flows
[AD-A138697] N84-22915
ENGINE MONITORING INSTRUMENTS
Engine reliability through bearing condition monitoring — aircraft engines
[PNR-90168] N84-22570
ENGINE PARTS
Acoustic emission: A brief introduction to some of its uses in the aero engine industry
[PNR-90172] N84-22571
The development of advanced specimen testing and analysis techniques applied to fracture mechanics lifing of gas turbine components
[PNR-90179] N84-22575
A review of advanced manufacturing technology — gas turbine components
[PNR-90194] N84-22815
Laser drilling of aero engine components
[PNR-90185] N84-22956
ENGINE TESTS
Preliminary investigation of a two-zone swirl flow combustor
[NASA-TM-83637] N84-22565
Rocket motor aeroacoustics N84-22642
Coupling between velocity oscillations and solid propellant combustion N84-22643
Fluid-dynamically coupled solid propellant combustion instability - cold flow simulation N84-22644
Effect of oscillations upon velocity distributions in simulated solid propellant flow environments N84-22646
Investigation of combustion characteristics of a high chamber pressure rocket motor N84-22693
ENGINEERING
Glossary of Software Engineering Laboratory terms
[NASA-TM-85606] N84-23135
ENGINEERING DRAWINGS
Design and development of a hybrid tracker point focus fresnel passively cooled concentrator photovoltaic array
[DE84-006365] N84-23031
ENGINEERING MANAGEMENT
Managers handbook for software development
[NASA-TM-85604] N84-23150
Thomson semiconductors bipolar IC strategy to 1986 N84-23227

ENGINES
Engine product performance agreements and the future
[AD-P002821] N84-23366
ENGLISH CHANNEL
Waves recorded off the Eddystone lighthouse. Data for September 1978 to August 1981 at position 50 deg 10 min N, 004 deg 15 min W: Summary analysis and interpretation report
[IOS-132] N84-23090
ENTHALPY
Asymptotic condensed phase analysis of deflagrating monopropellants with subsurface exothermicity N84-22656
Analysis of production data from the Krafla geothermal field, Iceland
[DE84-006661] N84-23014
ENTIRE FUNCTIONS
On a fundamental inequality and the singularities of an analytic function defined by the LC-Dirichletian element N84-23177
ENTROPY
The influence of specific reactant-solvent interactions on intrinsic activation entropies for outer-sphere electron transfer reactions
[AD-A139081] N84-22725
ENVIRONMENT EFFECTS
Wind power generation design considerations
[AD-A138041] N84-23029
A study of MX environmental management information system (MXEMIS) needs
[AD-A139025] N84-23404
ENVIRONMENT MANAGEMENT
A study of MX environmental management information system (MXEMIS) needs
[AD-A139025] N84-23404
ENVIRONMENT MODELS
Geologic studies of outer solar system satellites: Iapetus and Europa N84-23448
ENVIRONMENT SIMULATION
Properties of simulated comet mantle N84-23452
Wind abrasion on Venus: A means for experimental investigations N84-23455
Aeolian processes on Venus N84-23456
EPITAXY
Low-cost GaAs solar cell development
[AD-A139938] N84-23280
EPOXY RESINS
The curing of a biphenol A type epoxy resin with 1,8 Diamino-P-Menthane
[AD-A138977] N84-22761
EQUATIONS OF MOTION
Dynamics analysis of electrodynamic satellite tethers. Equations of motion and numerical solution algorithms for the tether
[NASA-CR-171777] N84-22598
Active control of distributed structures N84-22618
Approach to solving problem of acoustic wave diffraction by elastic shell N84-22804
Balancing of flexible rotors with simultaneous precise determination of influencing factors N84-22806
Microcomputer numerical analysis system for gas dynamics application
[NASA-CR-171005] N84-22908
Biaxial orientation and mechanical properties of amorphous polymers N84-22965
Attitude and shape control of large space structures N84-23091
EQUATIONS OF STATE
Molecular dynamics of propellant gases N84-22674
EQUATORIAL REGIONS
Rayleigh-Taylor instability in the presence of a stratified shear layer
[AD-A138544] N84-23043
EROSION
Cathode degradation and erosion in high pressure arc discharges
[NASA-TM-83638] N84-22631
New models for landform evolution on Io N84-23443
Wind abrasion on Venus: A means for experimental investigations N84-23455
Planetary geomorphology field studies: Iceland and Antarctica N84-23514
Temporal and spatial distribution of exhumed topography N84-23517
Valles Marineris layered deposits: Implications of origin N84-23537
ERROR ANALYSIS
Feasibility anlysis of novel technological principles of producing multicomponent mechaniams N84-22773
Applications of coding to spread spectrum communications N84-22829
Spread spectrum data networks N84-22832
Structural coverage of functional testing N84-23141
An error-specific approach to testing N84-23143
Transformations of software design and code may lead to reduced errors N84-23145
Fast evaluation of the numerical error rate in the presence of interasymbolic interference
[CRPE-NT-127] N84-23158
A posteriori error analysis in L sub p norms for the finite element method
[CTH-MATH-1983-15] N84-23198
ERROR CORRECTING CODES
Applications of coding to spread spectrum communications N84-22829
Trends in convolutional coding N84-22830
ERROR FUNCTIONS
Analysis of a fully discrete scheme for the neutron transport in cylindrical geometry
[CTH-MATH-1984-1] N84-23248
ERRORS
A study of Western North Pacific tropical storms and typhoons that intensify after recurvature
[AD-A138792] N84-23075
Stability and performance deterioration due to modelling errors — plant models
[RR-236] N84-23166
ERS-1 (ESA SATELLITE)
Study of wind scatterometer antenna for ERS-1. Volume 1: Executive summary report
[Y/A-3380] N84-23080
Study of windscatterometer antenna for ERS-1
[MIX/A-3188] N84-23081
ESCARPMENTS
A tectonic geomorphological classification of the walls of Valles Marineris N84-23518
ESTERS
Modeling effects of composition on the burn rates of nitrate ester-based energetic binders N84-22685
ESTIMATES
Distributed estimation systems
[AD-P002898] N84-22857
Optimal maneuver detection and estimation in multiobject tracking
[AD-P002899] N84-22858
Estimating monthly rainfall from geostationary satellite imagery over Amazonia, Brazil N84-23069
Estimates of one-dimensional oscillatory integrals N84-23179
Morphology of buried craters: Lava thickness estimates by simulated flooding N84-23471
ESTIMATING
On 'Before' and 'After' cost comparisons
[AD-P002799] N84-23345
ETCHING
Method of making an ion beam sputter-etched ventricular catheter for hydrocephalus shunt
[NASA-CASE-LEW-13107-2] N84-23095
ETHYL COMPOUNDS
Ethynyl and substituted ethynyl-terminated polysulfones
[NASA-CASE-LAR-12931-1] N84-22747
ETHYLENEDIAMINE
Intramolecular electron transfer at metal surfaces. 1. Relative energetics of some corresponding outer- and inner-sphere pathways involving halide and pseudohalide bridging ligands
[AD-A139021] N84-22716
EUROPA
The Laplacian resonance and tidal dissipation N84-23434
Geologic studies of outer solar system satellites: Iapetus and Europa N84-23448
EVALUATION
The CARFAX road traffic information system
[BBC-RD-1984/1] N84-22818
Review of free electron laser theory and experiments
[DE84-007232] N84-22954
Technical and economic indicators for industrial technological institutes N84-23392
EVAPORATION RATE
Evaporation from a bare soil evaluated from a soil water transfer model using remotely sensed surface soil moisture data
[CRPE-NT-125] N84-23016
EVAPOTRANSPIRATION
Evaporation from a bare soil evaluated from a soil water transfer model using remotely sensed surface soil moisture data
[CRPE-NT-125] N84-23016
EXCIMER LASERS
Plasma-initiated laser deposition of polycrystalline and monocrystalline silicon films
[DE84-005527] N84-22953
EXHAUST EMISSION
Experimental investigation of the low NO/sub x vortex airblast annular combustor
[NASA-TM-83615] N84-22567
Emissions variability and traversing on production RB211 engines
[PNR-90176] N84-22573
The design and development of a low emissions Transply combustor for the civil Spey engine
[PNR-90198] N84-22582
EXHAUST FLOW SIMULATION
Coupling between velocity oscillations and solid propellant combustion N84-22643
Fluid-dynamically coupled solid propellant combustion instability - cold flow simulation N84-22644
Effect of oscillations upon velocity distributions in simulated solid propellant flow environments N84-22648
EXHAUST NOZZLES
The 14th JANNAF Plume Technology Meeting, volume 1
[AD-A139654] N84-22619
CONTAM 3 plus improved CONTAM 3 usability N84-22622
Operational update to the RCS flow field of the space shuttle orbiter N84-22626
Aircraft exhaust plume signature predictions for non-axisymmetric multiple engine installations N84-22627
EXOTHERMIC REACTIONS
Asymptotic condensed phase analysis of deflagrating monopropellants with subsurface exothermicity N84-22656
EXPANSION
Effect of pressure on the mechanical properties of polymers, part 1
[DE84-006311] N84-22765
EXPERT SYSTEMS
Integrated testing and maintenance technologies
[AD-A138587] N84-22528
Research on cognitive collaboration between persons and computers
[AD-P002892] N84-22853
A cost based acquisition planning model utilizing expert system concepts
[AD-P002783] N84-23330
Expert systems for price analysis: A feasibility study
[AD-P002795] N84-23341
EXPLOSIONS
Experiments on water/melt explosions, nature of products, and models of dispersal N84-23483
EXPLOSIVE DEVICES
Effect of fabrication techniques on consolidated charge burning N84-22668
Discrete charge diagnostics on Pre-DIRECT COURSE
[AD-A139073] N84-22919
EXPLOSIVE FORMING
Shock consolidation of powders: Theory and experiment
[DE84-007273] N84-22741
EXPLOSIVES
Status of ammonium nitrate in propellants and explosives N84-22655
EXPONENTIAL FUNCTIONS
Big omega versus the wild functions
[MC-IW-239/83] N84-23200
EXPONENTS
Exponential calculus of microdifferential operators of infinite order, part 1 N84-23181
EXTRACTION
Supercritical solvent coal extraction
[NASA-CASE-NPO-15210-1] N84-22709
EXTRAGALACTIC RADIO SOURCES
Study of variability in extragalactic radio sources at 22 GHz and 44 GHz
[INPE-2913-TDL/149] N84-23549
Quenchings and outbursts of extragalactic radio sources: Nine years of 3.3-mm measurements and comparisons with centimeter-wave variations
[AD-A138233] N84-23550
EXTRAPOLATION
The luminosity function of galaxies in CO-12 N84-23424
EXTRATERRESTRIAL ENVIRONMENTS
Activities report of the Institute for Extraterrestrial Physics N84-23407
EXTRATERRESTRIAL RESOURCES
A review of in situ propellant production techniques for solar system exploration
[NASA-CR-173494] N84-22595
EXTREMELY HIGH FREQUENCIES
Analysis of propagation conditions at 20 and 30 GHz in Europe
[CRPE-NT-122] N84-22680
EYE PROTECTION
Safety eye protection through use of fast acting optical switching
[AD-A138582] N84-23120

F

F REGION
Rayleigh-Taylor instability in the presence of a stratified sheer layer
[AD-A136544] N84-23043
F-layer ionization patches in the polar cap
[AD-A136633] N84-23044
FABRICATION
Preliminary results of the effects of sewing, packing and parachute deployment on material strength
[DE84-006464] N84-22541
Effect of fabrication techniques on consolidated charge burning N84-22668
Method of making a light weight battery plaque
[NASA-CASE-LEW-13349-1] N84-22734
An assessment of the reliability of edge connectors — circuit boards
[ERA-82-22] N84-22888
Novolac as stain protective film during optical glass fabrication
[DE84-005735] N84-23260
FACTOR ANALYSIS
Kerma factors for use in 37-group neutron spectrum calculations
[AD-A139033] N84-23240
FACTORIZATION
Factoring multivariate integral polynominals
[MC-IW-229/83] N84-23190
Factoring multivariate integral polynomials, part 2
[MC-IW-230/83-PT-2] N84-23191
Polynomial factorization by root approximation
[MC-IW-242/83] N84-23201
FAILURE
System safety study of minimum TCAS II (Traffic Alert and Collision Avoidance System)
[AD-A138674] N84-22548
FAILURE ANALYSIS
Ceramic-to-metal bonding for pressure transducers
[NASA-CR-173500] N84-22753
An assessment of the reliability of edge connectors — circuit boards
[ERA-82-22] N84-22888
Factors influencing thermomechanical failure of face seals, 3
[AD-A138546] N84-22961
Teardown analysis of a ten cell bipolar nickel-hydrogen battery
[NASA-TM-83618] N84-23026
Central Demand Data Base (CDDB) End Item Code (EIC)
[AD-P002807] N84-23353
FAILURE MODES
Testability of VLSI (Very Large Scale Integration) leakage faults in CMOS (Complementary Metal Oxide Semiconductor)
[AD-A138978] N84-23261
FAR FIELDS
Operational update to the RCS flow field of the space shuttle orbiter N84-22626
New formulas that extend Norton's farfield elementary dipole equations to the quasi-nearfield range
[AD-A139057] N84-23188
FAR INFRARED RADIATION
Review of free electron laser theory and experiments
[DE84-007232] N84-22954
Near millimeter wave action in n-GaAs
[AD-A138602] N84-23252
FAST FOURIER TRANSFORMATIONS
Computation of radiation in stratified media by Fast Fourier Transform (FFT)
[AD-A138647] N84-22669
FATIGUE (MATERIALS)
The fatigue of powder metallurgy alloys
[AD-A138714] N84-22738
Crack layer theory
[NASA-CR-174634] N84-22980
FATIGUE LIFE
The development of advanced specimen testing and analysis techniques applied to fracture mechanics lifing of gas turbine components
[PNR-90179] N84-22575
FEASIBILITY ANALYSIS
Feasibility anlysis of novel technological principles of producing multicomponent mechanisms N84-22773
FEEDBACK CONTROL
Dynamic stifness of closed gas-static bearing with regulator N84-22774
Three phase power factor controller
[NASA-CASE-MFS-25535-2] N84-22885
Parameterization and approximation methods in feedback theory with applications in high gain, fast sampling and cheap optimal control
[RR-241] N84-23167
FIBER COMPOSITES
Select fiber composites for space applications: A mechanistic assessment
[NASA-TM-83631] N84-22702
Phosphorus-containing imide resins
[NASA-CASE-ARC-11368-3] N84-22745
FIBER OPTICS
Advanced diagnostics for reacting flows N84-22637
Transmitting two-level balanced code within the bandwidth of straight binary code-transmission N84-23231
FIBER REINFORCED COMPOSITES
Large deformation behavior of long shallow cylindrical composite panels
[NASA-CR-173286] N84-22975
FIBERS
Phosphorus-containing imide resins
[NASA-CASE-ARC-11368-3] N84-22745
FIELD OF VIEW
The effect of haze on an operator's visual field and his target detection performance
[AD-A138330] N84-23099
FIELD STRENGTH
Electromagnetic radiation and scattering from a system of conducting bodies interconnected by wires N84-22882
FIELD THEORY (ALGEBRA)
Annals of the Fourier Institute, volume 33, no. 4
[ISSN-0373-0956] N84-23172
On the Z sub 2 extensions of an imaginary quadratic field N84-23173
Formal and group Picard localization N84-23174
FIGHTER AIRCRAFT
Integrated testing and maintenance technologies
[AD-A138587] N84-22526
Assessment of aerodynamic performance of V/STOL and STOVL fighter aircraft
[NASA-TM-85937] N84-22536
Development and analysis of a STOL supersonic cruise fighter concept
[NASA-TM-85777] N84-22553
Quantification of subjective ratings through conjoint measurement analysis
[AD-A138810] N84-22554
Some themes on Rolls-Royce military engine technology. Part 1: Old and new engines for combat aircraft. Part 2: After-burning technology
[PNR-90195] N84-22579
FILAMENTS
Modes of deformation and failure of Kevlar 49 fibers and composites
[DE84-004162] N84-22706
FILE MAINTENANCE (COMPUTERS)
On the generation and use of quantitative criteria for assessing software maintenance quality N84-23128
FILES
Documentation for the machine-readable version of a table of Redshifts for Abell clusters (Sarazin, Rood and Struble 1982)
[NASA-TM-85571] N84-23417
FILM COOLING
Film cooling on a gas turbine blade near the end wall
[AD-A138794] N84-22569
Vortex generating flow passage design for increased film-cooling effectiveness and surface coverage — aircraft engine blade cooling
[NASA-TM-83617] N84-22909
FILTERS
Target super-resolution compensation for coherent airborne radar utilizing spread spectrum waveforms
[AD-A138545] N84-22666
Boron in the marine atmosphere N84-23038
Yellow ophthalmic filters in the visual acquisition of aircraft
[AD-A138536] N84-23097
FINANCE
Cost risk trade-offs in timing the production decision
[AD-P002753] N84-23300
FINE STRUCTURE
Far-IR spectroscopy of the galactic center: Neutral and ionized gas in the central 10 pc of the galaxy
[NASA-CR-166510] N84-23411
FINITE DIFFERENCE THEORY
Calculation of the flow over a stalled airfoil N84-22531
Numerical analysis of an unsteady shock in an inlet diffuser N84-22668
Numerical predictions of residence times behind a rearward facing step with transverse injection N84-22667
A discrete-element analysis for large deflection of thin plates: A combined effect of geometric and material nonlinearities N84-22995
FINITE ELEMENT METHOD
Transonic flow calculations using triangular finite elements N84-22529
Factors influencing thermomechanical failure of face seals, 3
[AD-A138546] N84-22961
Finite element analysis of structure subjected to nonstationary load fields with contact interfaces N84-22993
Influence of extratropical heterocrological phenomenon on the northeast Brazilian climate: A study using finite elements
[INPE-2912-PRE/425] N84-23072
A posteriori error analysis in L sub p norms for the finite element method
[CTH-MATH-1983-15] N84-23198
FIXED POINTS (MATHEMATICS)
Process algebra semantics for queues
[MC-IW-241/83] N84-23219
FLAKES
Diamondlike flakes
[NASA-CASE-LEW-13837-2] N84-22696
FLAME PROPAGATION
Multi-dimensional, multiphase flow analysis of flamespreading in a stick propellant charge N84-22663
FLAME RETARDANTS
Fire and heat resistant laminating resins based on maleimido substituted aromatic cyclotriphosphazenes
[NASA-CASE-ARC-11428-1] N84-22697
Phosphorus-containing imide resins
[NASA-CASE-ARC-11368-3] N84-22745
FLAME SPECTROSCOPY
Mechanism of soot formation in premixed C2H2/O2 flames N84-22727
FLAME STABILITY
Heterogeneous diffusion flame stabilization: Constant density results N84-22689
FLAME TEMPERATURE
Investigation of organic oxidizers for high performance low flame temperature gas generator applications N84-22676
FLAT PLATES
Interaction of unsteady spatial boundary layer with hypersonic flow near rapidly heated portion of surface N84-22794
Two-dimensional scanner apparatus — flaw detector in small flat plates
[NASA-CASE-MFS-25687-1] N84-22928
FLEXIBLE BODIES
Application of control theory to large flexible structures using the independent modal-space control method N84-22617
Work capsule for lightweight hydrostatic machines
[CSIR-RR-581] N84-22905
FLIGHT CHARACTERISTICS
Model identification and parameter estimation of the power, lift, and drag of light aircraft from a single maneuver N84-22552
Characteristics of a prototype experiment N84-23140
Assessment of the NASA Flight Assurance Review Program
[NASA-CR-173418] N84-23401
FLIGHT INSTRUMENTS
A new satellite instrument for yaw and pitch measurements
[AD-A138729] N84-22599
FLIGHT SAFETY
System safety study of minimum TCAS II (Traffic Alert and Collision Avoidance System)
[AD-A138674] N84-22548
Assessment of the NASA Flight Assurance Review Program
[NASA-CR-173418] N84-23401
FLIGHT SIMULATION
Model identification and parameter estimation of the power, lift, and drag of light aircraft from a single maneuver N84-22552
Atmospheric turbulence simulation for Shuttle orbiter
[NASA-CR-171013] N84-22602
FLIGHT SIMULATORS
Device 2E6 (ACMS) Air Combat Maneuvering Simulator instructor console review
[AD-A136972] N84-22587
FLIGHT TESTS
Data acquisition and aerodynamic coefficient estimation at high angles of attack N84-22542
FLOATS
State space method for optimal design of shock absorbers with floating boundaries N84-22966
FLOW
Classification of volcanoes of the Kane Patera Quadrangle of Io: Proportions of lava flows and pyroclastic flows N84-23477
FLOW CHARACTERISTICS
Vortex generating flow passage design for increased film-cooling effectiveness and surface coverage — aircraft engine blade cooling
[NASA-TM-83617] N84-22909

Bellows flow-induced vibrations
[NASA-TM-82556] N84-22912
Effusion rate, length, and area relationships for some lava flows on Hawaii and Mount Etna with planetary implications N84-23482
The 19 March 1982 eruption and lahar at Mount Saint Helens: Implications for Martian outflow channels? N84-23495
Planetary geomorphology field studies: Washington and Alaska N84-23501

FLOW DISTRIBUTION
Analysis of inviscid and viscous flows in cascades with an explicit multiple-grid algorithm
[NASA-TM-83636] N84-22527
Experimental investigation of the internal flow field in STOL engine inlets N84-22544
The 14th JANNAF Plume Technology Meeting, volume 1
[AD-A139654] N84-22619
Application of the CONTAM 3 computer model to the prediction of heating, forces, and contamination on a communications satellite N84-22621
CONTAM 3 plus improved CONTAM 3 usability N84-22622
Exhaust plume induced fluctuations in the index of refraction at optical wavelengths N84-22624
Multiple point source model for three dimensional plume flow fields N84-22625
Operational update to the RCS flow field of the space shuttle orbiter N84-22626
Aircraft exhaust plume signature predictions for non-axisymmetric multiple engine installations N84-22627
On the oscillatory flowfield in solid rocket motors N84-22645
Effect of oscillations upon velocity distributions in simulated solid propellant flow environments N84-22646
Numerical analysis of an unsteady shock in an inlet diffuser N84-22686
Heterogeneous diffusion flame stabilization: Constant density results N84-22689
Detailed flow measurements in fuel-rich, particle-laden plumes N84-22690
Hypersonic flow around flat body in case of intense radiative heat exchange N84-22795
Theoretical investigation of three-dimensional shock wave-turbulent boundary layer interactions, part 2
[AD-A138722] N84-22916
Development of holographic interferometry for welding arc analysis
[DE84-005454] N84-22940

FLOW EQUATIONS
Hypersonic flow around flat body in case of intense radiative heat exchange N84-22795
Aerodynamic effect of combustor inlet-air pressure on fuel jet atomization
[NASA-TM-83611] N84-22910

FLOW GEOMETRY
Experimental investigations of rivulet meanders — flow instability
[MPIS-5/1983] N84-23015

FLOW MEASUREMENT
Flow measurement facilities at NEL on 1 August 1983
[NEL-686] N84-22924

FLOW STABILITY
Rocket motor aeroacoustics N84-22642
Fluid-dynamically coupled solid propellant combustion instability - cold flow simulation N84-22644
Three-dimensional vorticity procedure interactions in combustion instability analysis of solid propellant rocket motors N84-22647
Generation of vehicle wobbling by the unsteady flow field in a spinning solid propellant rocket motor N84-22648
Direct measurement of high frequency solid propellant response functions N84-22649
A novel X-ray backlighting method for Rayleigh-Taylor instability measurements on ablatively driven targets
[AD-A138644] N84-22937
Experimental investigations of rivulet meanders — flow instability
[MPIS-5/1983] N84-23015

FLOW VELOCITY
Effect of oscillations upon velocity distributions in simulated solid propellant flow environments N84-22646
Hypersonic flow around flat body in case of intense radiative heat exchange N84-22795
Chronology, morphology and stratigraphy of pumiceous pyroclastic-flow (ignimbrite) deposits from the eruption of Mount St. Helens on 18 May 1983 N84-23476

FLOW VISUALIZATION
An experimental and analytic study of the flow subsonic wind tunnel inlets
[AD-A138665] N84-22540
Experimental investigation of the internal flow field in STOL engine inlets N84-22544
Film cooling on a gas turbine blade near the end wall
[AD-A138794] N84-22569
Flash X-ray with image enhancement applied to combustion events N84-22666
Visualisation of the vortex dominated flow around a delta wing-body combination using a water tunnel
[BAE-821/RES/6631] N84-22904
Experimental observations of vortex ring interaction with the fluid adjacent to a surface
[AD-A138999] N84-22917

FLUID DYNAMICS
The 20th JANNAF Combustion Meeting, volume 1
[AD-A139033] N84-22632

FLUID FLOW
Microcomputer numerical analysis system for gas dynamics application
[NASA-CR-171005] N84-22908
Flow measurement facilities at NEL on 1 August 1983
[NEL-686] N84-22924

FLUID MECHANICS
USSR report: Engineering and equipment
[JPRS-UEQ-84-004] N84-22772
Central burst of simultaneously rotating and gravitating body N84-22783
Vortex generating flow passage design for increased film-cooling effectiveness and surface coverage — aircraft engine blade cooling
[NASA-TM-83617] N84-22909

FLUTTER ANALYSIS
Calculation of apparent masses in blade ring N84-22793

FLUX (RATE)
On the rate of energy input in thermal solar flares
[AD-A138345] N84-23548

FLY BY WIRE CONTROL
Technology review of flight crucial flight controls
[NASA-CR-172332] N84-22583

FLYWHEELS
Study of flywheel energy storage for space stations
[NASA-CR-171760] N84-23028

FOKKER-PLANCK EQUATION
Stochastic dynamical systems with a cyclic structure
[MC-TW-247/83] N84-23214

FORECASTING
FAA (Federal Aviation Administration) aviation forecasts -Fiscal Years 1984-1995
[AD-A138759] N84-22549

FOREST MANAGEMENT
The Pennsylvania defoliation application pilot test
[E84-10111] N84-23004

FORGING
A review of advanced manufacturing technology — gas turbine components
[PNR-90194] N84-22815

FORMULAS (MATHEMATICS)
New formulas that extend Norton's farfield elementary dipole equations to the quasi-nearfield range
[AD-A139057] N84-23188

FORTRAN
Structural coverage of functional testing N84-23141

FORWARD SCATTERING
AWOS (Automatic Weather Observing System) sensor evaluation. Transmissometer, forward-scatter meter and lidar ceilometer
[AD-A138743] N84-23074

FOSSIL FUELS
Supercritical solvent coal extraction
[NASA-CASE-NPO-15210-1] N84-22709

FOSSILS
Sedimentology and invertebrate paleontology of Triassic and Jurassic Lacustrine deposits, Culpeper Basin, northern Virginia N84-23064

FOURIER TRANSFORMATION
Deformation studies of polymers by Fourier transform infrared spectroscopy N84-22751
The Fourier Plancherel transform of the analytic Lie group. 1: Weyl algebras and differential operators N84-23176
Estimates of one-dimensional oscillatory integrals N84-23179
The 1983 International Conference on Fourier Transform Spectroscopy September 1983
[AD-A139014] N84-23258
Dynamics and evolution of cD galaxies N84-23425

FRACTURE MECHANICS
The development of advanced specimen testing and analysis techniques applied to fracture mechanics lifing of gas turbine components
[PNR-90179] N84-22575
Micromechanics of fracture in elastomers
[AD-A138783] N84-22758
Aeronautics and Space Engineering Board: Aeronautics Assessment Committee
[NASA-TM-85594] N84-22771
Prediction of fatigue crack-growth patterns and lives in three-dimensional cracked bodies
[NASA-TM-85787] N84-22979
Fracture toughness processes
[DE84-007244] N84-22989
Ancient volcano-tectonic structures of the Olympus Mons Region, Mars N84-23535

FRACTURE STRENGTH
Modes of deformation and failure of Kevlar 49 fibers and composites
[DE84-004162] N84-22706
Fracture toughness processes
[DE84-007244] N84-22989

FREE ELECTRON LASERS
Progress and problems in storage ring free electron lasers
[AD-A139883] N84-22948
Anomalous laser induced bunch lengthening on the ACO storage ring free electron laser
[AD-A138814] N84-22949
Review of free electron laser theory and experiments
[DE84-007232] N84-22954
UV and VUV degradation of very high reflectivity mirrors for use in a storage ring free electron laser
[AD-A138740] N84-23255

FREE FLOW
Experimental investigation of the internal flow field in STOL engine inlets N84-22544

FREE RADICALS
Investigations of radical-radical reactions using a far infrared Laser Magnetic Resonance (Fir-LMR) spectrometer
[MPIS-4/1983] N84-22730
Research into the thermal decompositon of selected energetic material candidates (Project order ATL-2-094)
[AD-A138730] N84-22770

FREEZING
Freezing of Martian streams under climatic conditions N84-23498

FREQUENCY CONTROL
Spectrophone stabilized laser with line center offset frequency control
[NASA-CASE-NPO-15516-1] N84-22943

FREQUENCY HOPPING
Target super-resolution compensation for coherent airborne radar utilizing spread spectrum waveforms
[AD-A138545] N84-22868

FREQUENCY MODULATION
Intermodulation between v.h.f./f.m. broadcast transmitters and the protection of adjacent-band aeronautical services
[BBC-RD-1984/2] N84-22819

FRICTION
Contact-stress analysis of elastic-viscoelastic interface conditions
[AD-A138834] N84-22759
Factors influencing thermomechanical failure of face seals, 3
[AD-A138546] N84-22961

FRICTION MEASUREMENT
Plane motion of solid body on rough surface of annular bearing rotating about its axis perpendicular to plane of motion N84-22801

FRICTION REDUCTION
Constant force friction damper
[NASA-CASE-MSC-20505-1] N84-22611
Plane motion of solid body on rough surface of annular bearing rotating about its axis perpendicular to plane of motion N84-22801

FUEL CELLS
Method of making a light weight battery plaque
[NASA-CASE-LEW-13349-1] N84-22734

FUEL COMBUSTION
Three-color pyrometer for burning particle temperature measurement N84-22635
Mechanism of soot formation in preximed C2H2/O2 flames N84-22727
Alternate fuels combustion research
[AD-A138575] N84-22769
Heat pipes to reduce engine exhaust emissions
[NASA-CASE-LEW-12590-1] N84-22958

FUEL CONSUMPTION
Fuel efficient engines for large transport — aircraft
[PNR-90196] N84-22580

FUEL CONTROL
Heat pipes to reduce engine exhaust emissions
[NASA-CASE-LEW-12590-1] N84-22958

FUEL INJECTION
Aerodynamic effect of combustor inlet-air pressure on fuel jet atomization
[NASA-TM-83611] N84-22910
Heat pipes to reduce engine exhaust emissions
[NASA-CASE-LEW-12590-1] N84-22958

FUEL TANKS
Tanker orbit transfer vehicle and method
[NASA-CASE-MSC-20543-1] N84-22610

FUNCTION SPACE
Annals of the Fourier Institute, volume 33, no. 4 [ISSN-0373-0956] N84-23172
Formal and group Picard localization N84-23174
Thin sets in nonlinear potential theory N84-23178
FUNCTIONAL DESIGN SPECIFICATIONS
A general purpose guidance simulation program: Software definition [BAE-BT-13122] N84-23132
FUNCTIONS (MATHEMATICS)
Littlewood Paley's g function associated with a singular differential operator (0, infinity) N84-23160
Formulas for the L-2 minimal solutions of the Delta Delta bar equation in the unit ball of C sup N [CTH-MATH-1983-16-PREPRINT] N84-23180
FURANS
Mass spectroscopic investigations of the reactions of O2 (1 deltag) with furan, 2-methylfuran, and 2,5-dimethylfuran in the gas phase [MPIS-7/1983] N84-22731
FURNACES
Direct digital control of the electric arc furnace [RR-233] N84-22811
FUSION (MELTING)
Absorbable-susceptor joining of ceramic surfaces [NASA-CASE-NPO-15840-1] N84-22748
Multicolor printing plate joining [NASA-CASE-LEW-13598-1] N84-22930
FUZZY SETS
A unified approach to modeling and combining of evidence through random set theory [AD-P002880] N84-22841
FUZZY SYSTEMS
A unified approach to modeling and combining of evidence through random set theory [AD-P002880] N84-22841

G

GALACTIC NUCLEI
Far-IR spectroscopy of the galactic center: Neutral and ionized gas in the central 10 pc of the galaxy [NASA-CR-166510] N84-23411
GALAXIES
Documentation for the machine-readable version of a table of Redshifts for Abell clusters (Sarazin, Rood and Struble 1982) [NASA-TM-85571] N84-23417
Activities report of the Institute of Astronomy N84-23422
Dynamics and evolution of cD galaxies N84-23425
GALILEAN SATELLITES
Theoretical aspects of photoclinometric terrain profiling on the Galilean satellites N84-23441
Galilean satellite multispectral data base production N84-23521
Multi-image photometric solutions for the Galilean satellites N84-23522
The Galilean Satellite Geological Mapping Program, 1983 N84-23541
GALLIUM ARSENIDE LASERS
Near millimeter wave action in n-GaAs [AD-A138602] N84-23252
GALLIUM ARSENIDES
Low-cost GaAs solar cell development [AD-A138938] N84-23280
Production oriented 3-5 epitaxy [BMFT-FB-T-83-266] N84-23290
GALLIUM PHOSPHIDES
Production oriented 3-5 epitaxy [BMFT-FB-T-83-266] N84-23290
GAME THEORY
A formulation and analysis of combat games [NASA-TM-85927] N84-22585
Spread spectrum communication in jamming N84-22827
Lanchester's equations and game theory [AD-P002877] N84-22838
Informational aspects of a class of subjective games of incomplete information [AD-P002910] N84-22862
Dynamic, hierarchical decision problems [AD-P002912] N84-22863
GANYMEDE
Ice-covered volcanic water flows on Ganymede N84-23432
The Laplacian resonance and tidal dissipation N84-23434
Topography on Ganymede derived from photoclinometry N84-23442
Morphology of fresh craters on Ganymede and the origin of pedestal craters N84-23466
Relationships and tectonics of the Jg-7 quadrangle of Ganymede N84-23542
Geologic investigations of outer planets satellites [NASA-CR-173497] N84-23544
GAS ANALYSIS
Computer controlled laser optoacoustic spectroscopy for trace gas analysis N84-22710
GAS BEARINGS
Dynamic stiffness of closed gas-static bearing with regulator N84-22774
Improvement of dynamic characteristics of gas-static bearings N84-22775
Effect of hydromechanical inertia forces on stability of cylindrical hydrodynamic bearing N84-22789
Improved compliant hydrodynamic fluid journal bearing [NASA-CASE-LEW-13670-1] N84-22959
GAS CHROMATOGRAPHY
Modulated voltage metastable ionization detector [NASA-CASE-ARC-11503-1] N84-23093
GAS DETECTORS
Liquid-phase photoionization detector for liquid chromatography N84-22711
GAS DISCHARGE TUBES
Utilizing light focusing by gas discharge medium for stabilization of emission power of He-Ne laser at wavelength of 6401 angstroms N84-22779
GAS DISCHARGES
Improvement of dynamic characteristics of gas-static bearings N84-22775
GAS DYNAMICS
Mach number and density effects in the mixing of supersonic jets N84-22628
Molecular dynamics of propellant gases N84-22674
Discharge of ideal gas into vacuum N84-22785
More precise numerical simulation of transonic flow through passages in turbomachines N84-22786
Microcomputer numerical analysis system for gas dynamics application [NASA-CR-171006] N84-22908
Loeb solutions of the Boltzmann equation [CTH-MATH-1983-82] N84-22926
Thermodynamics and kinetics of the gas phase and pack aluminide coating formation on iron and steel N84-23291
GAS EXPANSION
Central burst of simultaneously rotating and gravitating body N84-22783
GAS GENERATORS
Investigation of organic oxidizers for high performance low flame temperature gas generator applications N84-22676
GAS LASERS
Spectrophone stabilized laser with line center offset frequency control [NASA-CASE-NPO-15516-1] N84-22943
The electron density and temperature in the photoionized background gas (N2) surrounding a laser produced plasma [AD-A138651] N84-23266
GAS SPECTROSCOPY
Spectroscopic measurements of the Laser-HANE plasma [AD-A138685] N84-22947
GAS TRANSPORT
Thermodynamics and kinetics of the gas phase and pack aluminide coating formation on iron and steel N84-23291
GAS TUNGSTEN ARC WELDING
Measurement of melt line penetration and heat flux during arc spot welding [DE84-002013] N84-22962
Weld penetration variations [DE84-007915] N84-22963
GAS TURBINE ENGINES
Tip cap for a rotor blade [NASA-CASE-LEW-13654-1] N84-22560
Oxidizing seal for a turbine tip gas path [NASA-CASE-LEW-14053-1] N84-22563
The development of advanced specimen testing and analysis techniques applied to fracture mechanics lifing of gas turbine components [PNR-90179] N84-22575
Industrial and marine engine derivatives: A spin-off from aviation — gas turbine engines [PNR-90197] N84-22581
The cyclic behaviour of a powder Ni-base superalloy — aircraft engines [PNR-90182] N84-22743
Multi-small hole drilling by EDM — electrodischarge machining (EDM) [PNR-90184] N84-22813
Laser drilling of aero engine components [PNR-90185] N84-22956
Improved compliant hydrodynamic fluid journal bearing [NASA-CASE-LEW-13670-1] N84-22959
GAS TURBINES
Dual clearance squeeze film damper [NASA-CASE-LEW-13506-1] N84-22562
Comparison between measured turbine stage performance and the predicted performance using quasi-3D flow and boundary layer analyses [NASA-TM-83640] N84-22564
Film cooling on a gas turbine blade near the end wall [AD-A138794] N84-22569
Optical gas temperature measurement in gas turbines [PNR-90174] N84-22572
Effect of rotation on thermal state of runner blade through effect on heat transfer on coolant side N84-22787
Estimation of local stress intensity in flanged thin-wall shell structures under heavy thermal load N84-22799
Stressed-strained state of flanged shells under heavy thermal load beyond elastic limit N84-22800
Nonlinear/transient rotor dynamics analysis N84-22977
GAS-SOLID INTERACTIONS
An exactly solvable model for ideally polarizable interfaces [AD-A138719] N84-23182
The ideally polarizable interface: A solvable model and general sum rules [AD-A138720] N84-23207
GASEOUS DIFFUSION
Thermodynamics and kinetics of the gas phase and pack aluminide coating formation on iron and steel N84-23291
GASEOUS FUELS
Very low thrust gaseous oxygen-hydrogen rocket engine ignition technology N84-22692
GASEOUS SELF-DIFFUSION
Theoretical influence of the deposition conditions on the uniformity of boron carbide coatings N84-22707
GASES
Exact solution to problem of interaction between wedge moving at supersonic velocity and interface of two gaseous media N84-22790
The calculation of the heat transfer associated with the injection of methane gas at the stagnation point of the dissociated boundary layer of the laminar air flow [AD-A139063] N84-22918
Power transfer for microwave discharges [AD-A138668] N84-23267
GASKETS
Process for preparing perfluorotriazine elastomers and precursors thereof [NASA-CASE-ARC-11402-1] N84-22744
GEOCHEMISTRY
Stratigraphic, geochemical, and petrologic studies of the Ammonoosuc volcanics, northcentral Massachusetts and southwestern New Hampshire N84-23059
Geology, geochemistry, and geochronology of volcanic rocks between Cuauhtemoc and La Junta, central Chihahua, Mexico N84-23066
Surface compositions in the Aristarchus Region: Implications for regional stratigraphy N84-23519
A case for olivine on Mars N84-23520
GEOCHRONOLOGY
Geology and geochronology of the southeast border of the Bitterroot Dome: Implications for the structural evolution of the Mylonitic Carapace N84-23065
Geology, geochemistry, and geochronology of volcanic rocks between Cuauhtemoc and La Junta, central Chihahua, Mexico N84-23066
GEODESY
Scientific activity in oceanography, 1979-1982 N84-23084
GEODYNAMICS
Geologic investigations of outer planets satellites [NASA-CR-173497] N84-23544
GEOIDS
Geodetic use of GEOSAT-A [AD-A137993] N84-23048
GEOLOGICAL FAULTS
Age and evolution of the Yukon-Tanana Terrane, southeastern Yukon Territory N84-23060
Neotectonics of the north frontal fault system of the San Bernardino Mountains, southern California: Cajon Pass to Lucerne Valley N84-23061
Geology, geochemistry, and geochronology of volcanic rocks between Cuauhtemoc and La Junta, central Chihahua, Mexico N84-23066
Structure of the Brevard Zone and Blue Ridge near Lenoir, North Carolina, with observations on oblique crenulation cleavage and a preliminary theory for irrotational structures in shear zones N84-23067
Ice-covered volcanic water flows on Ganymede N84-23432
Relationships and tectonics of the Jg-7 quadrangle of Ganymede N84-23542
GEOLOGICAL SURVEYS
Characterization of surficial geologic units on Venus from Pioneer Venus radar data: A progress report N84-23454

GEOLOGY
Geology of Dione N84-23444
The Corfu landslide: Analog to giant landslides on Mars N84-23513
Interpretation of planetary stress systems: Determination of tectonic over-printing in Northwest Wyoming N84-23540

GEOMAGNETIC PULSATIONS
Observations of short period magnetic pulsations during the SBARMO-79 campaign: Data summary [REPT-60/1982] N84-23052
Quick-look tables of continuous pulsations (Pc1) and intervals of Pulsations of Diminishing Periods (IPDP) magnetic pulsation events recorded in Finland during IMS years 1976-1979: Data summary [REPT-62/1982] N84-23053

GEOMAGNETISM
Analysis of spacecraft charging, particle beams and geophysical data bases [AD-A136832] N84-22816
Use of MAGSAT anomaly data for crustal structure and mineral resources in the US midcontinent [E84-10112] N84-23005
Coherence study of geomagnetic fluctuations in frequency range .04 - 0.6 HZ between remote land sites [AD-A136542] N84-23042

GEOMETRIC RECTIFICATION (IMAGERY)
LANDSAT-D investigations in snow hydrology [E84-10094] N84-22997
Registration of TM data to digital elevation models N84-22999
Correction and geological analysis of lunar 3.8 CM radar data N84-23531

GEOMETRICAL THEORY OF DIFFRACTION
Scattering of an electromagnetic plane wave from a perfectly electrically conducting half-plane in the proximity of planar media discontinuities [AD-A136968] N84-22876

GEOMETRY
Space station architecture, module, berthing hub, shell assembly, berthing mechanism and utility connection channel [NASA-CASE-ARC-11505-1] N84-22612

GEOMORPHOLOGY
Geology of Maxwell Montes, Venus N84-23480
Mercury: New identification of ancient multi-ring basins and implications for geologic evolution N84-23483
Morphology of fresh craters on Ganymede and the origin of pedestal craters N84-23486
Differential degradation of Martian impact basins N84-23488
Geomorphic clues to the Martian volatile inventory. 1: Flow ejecta blankets N84-23474
Quantitative and experimental modelling of sapping networks N84-23500
Planetary geomorphology field studies: Washington and Alaska N84-23501
Permafrost on Mars: distribution, formation, and geological role N84-23506
Glacial and periglacial landforms in Denmark: Scandinavian analogs for Martian features N84-23507
Curvilinear ground on Mars: The search for terrestrial analogs N84-23508
Planetary geomorphology field studies: Iceland and Antarctica N84-23514
Geomorphic clues to the Martian volatile inventory: Landslides N84-23516
Temporal and spatial distribution of exhumed topography N84-23517
A tectonic geomorphological classification of the walls of Valles Marineris N84-23518
Elysium Region, Mars: Characterization of tectonic features N84-23534
Mars spiceostratigraphy N84-23536
Valles Marineris layered deposits: Implications of origin N84-23537
Geologic investigations of outer planets satellites [NASA-CR-173497] N84-23544

GEOPHYSICS
Handbook of geophysics and space environments, Chapter 15, 1983 revision: Atmospheric temperature, density and pressure [AD-A138646] N84-23076
Scientific activity in oceanography, 1979-1982 N84-23084

GEOTHERMAL ENERGY EXTRACTION
Oil shale extraction using super-critical extraction [NASA-CASE-NPO-15656-1] N84-23012
Generating capacity of the Heber geothermal field, California [DE84-006883] N84-23030

GEOTHERMAL RESOURCES
Analysis of production data from the Krafla geothermal field, Iceland [DE84-006881] N84-23014
Generating capacity of the Heber geothermal field, California [DE84-006883] N84-23030

GLASS
Precise measurement of refractive index and absorption coefficient of near millimeter wave and far infrared materials [AD-A138656] N84-23253
Role of abrasion in the optical polishing of metals and glass [DE84-005737] N84-23259
Novolac as stain protective film during optical glass fabrication [DE84-005735] N84-23260

GLASS ELECTRODES
Thermal endurance of silicone/glass sleeving by the cyclic electrical proof test method of IEC 216 (first report) [ERA-82-91] N84-22967
Thermal endurance of silicone/glass sleeving by the cyclic electrical proof test method of ICC 216 (second report) [ERA-82-136] N84-22968

GLASS FIBER REINFORCED PLASTICS
Work capsule for lightweight hydrostatic machines [CSIR-RR-561] N84-22905

GLOBAL POSITIONING SYSTEM
Navigation system and method [NASA-CASE-GSC-12508-1] N84-22546
Performance evaluation of a Magnavox GPS (Global Positioning System) Z-set [AD-A136569] N84-22547

GLOVES
Heat resistant protective hand covering [NASA-CASE-MSC-20261-2] N84-23113

GOVERNMENT PROCUREMENT
Proceedings of the Federal Acquisition Research Symposium with Theme: Government, Industry and Academe: Synergism for Acquisition Improvement [AD-A137700] N84-23293
Office automation in the acquisition environment [AD-P002747] N84-23294
Paperless solicitation and contracting [AD-P002749] N84-23296
Mechanized contract document preparation and abstract system [AD-P002750] N84-23297
Consolidation of DOD bidder's mailing list application [AD-P002752] N84-23299
Cost risk trade-offs in timing the production decision [AD-P002753] N84-23300
Managing program risk: One way to reduce cost growth [AD-P002754] N84-23301
DECISION TECHNOLOGY: The catalyst for acquisition improvement [AD-P002755] N84-23302
Designing the equitable risk contract [AD-P002756] N84-23303
Assumption of risk in the R and D environment [AD-P002757] N84-23304
An analysis of the acquisition strategy decision process along three dimensions of the acquisition improvement program [AD-P002758] N84-23305
Skunkworks 81 revisited: An update on acquisition strategy [AD-P002759] N84-23306
Assessing contracting workforce requirements in the matrixed organization [AD-P002760] N84-23307
The leader of the Army acquisition workforce [AD-P002762] N84-23309
Prerequisites for the establishment of a professional acquisition workforce [AD-P002763] N84-23310
Training requirements for changing times [AD-P002764] N84-23311
Training acquisition personnel through a local college [AD-P002766] N84-23313
Government - contractor interaction [AD-P002768] N84-23315
Needed help for the Federal Acquisition Regulation Council [AD-P002769] N84-23316
Competitive procurements: The synergistic linkage among government, industry and academe [AD-P002773] N84-23320
Competition: An integral part of the acquisition process [AD-P002774] N84-23321
Increasing spares competition in AFLC (Air Force Logistics Center) [AD-P002775] N84-23322
Award fee contract provisions as a program management tool [AD-P002776] N84-23323
Nailing down the liability issue once and for all [AD-P002777] N84-23324
Does the Prompt Payment Act insure timely contract payment? [AD-P002778] N84-23325
The make or buy decision--its nature and impact [AD-P002779] N84-23326
Multi-year procurement a 'Team approach' [AD-P002780] N84-23327
Cost risk and contract type: A normative model [AD-P002781] N84-23328
Contracting initiative: Best proposal for price [AD-P002782] N84-23329
A cost based acquisition planning model utilizing expert system concepts [AD-P002783] N84-23330
Computer Generated Acquisition Document System (CGADS) [AD-P002784] N84-23331
Computer Aided Source Selection (CASS) [AD-P002785] N84-23332
An application of the causal-integrative model [AD-P002786] N84-23333
An automated airframe production cost model [AD-P002787] N84-23334
Risk analysis: Comparing different contract types [AD-P002788] N84-23335
Managing for success in defense systems acquisition [AD-P002789] N84-23336
Nuclear reactor: On schedule and under cost [AD-P002790] N84-23337
Reshaping the philosophy of spare parts acquisition: Project PACER PRICE [AD-P002791] N84-23338
The problem of cost growth [AD-P002792] N84-23339
Economic production rate study [AD-P002793] N84-23340
Expert systems for price analysis: A feasibility study [AD-P002795] N84-23341
Contractor 'Hungriness' and the relative profitability of DoD business [AD-P002796] N84-23342
Independent cost estimates: A case study joint vertical lift aircraft (JVX) program [AD-P002797] N84-23343
An intelligent manual for price analysis [AD-P002798] N84-23344
Cost realism: Assuring more realistic contractor cost proposals [AD-P002800] N84-23346
Impact of corporate resource allocation decisions on national security objectives: Disaynergism in aerospace industrial resource planning [AD-P002801] N84-23347
Readiness planning in a peacetime environment [AD-P002803] N84-23349
Policy initiatives to achieve readiness and support objectives [AD-P002804] N84-23350
1982 US Army Materiel Development and Readiness Command (DARCOM) integrated logistic support (ILS) study finding on contracting for ILS [AD-P002805] N84-23351
The new MIL-STDs (Military standard) 1388 [AD-P002806] N84-23352
Project: Acquisition strategy [AD-P002809] N84-23355
Tactical buying decisions for strategic petroleum reserve spot procurements: The tunnel theory [AD-P002812] N84-23358
Incentives for product quality need contract, cost, production and field co-operation [AD-P002819] N84-23364
A quality improvement strategy for systems acquisition [AD-P002820] N84-23365
Defense systems acquisition review process: A history and evaluation [AD-P002822] N84-23367
A concept for mission-oriented planning for system acquisition at the Defense Communications Agency [AD-P002823] N84-23368
Mortality and spareparts: A conceptual analysis [AD-P002826] N84-23371
Improving the effectiveness of award fee contracts for program management support services [AD-P002827] N84-23372
Contract requirements: A key to controlling DoD acquisition costs [AD-P002828] N84-23373
The impact of factory automation and robotics on the contracting and acquisition processes [AD-P002830] N84-23375

A survey of contractor productivity measurement practices
[AD-P002831] N84-23376
Strengthening small business participation in Department of Defense extramural research and development
[AD-P002832] N84-23377
Employment changes resulting from the award of contracts in labor surplus areas
[AD-P002834] N84-23379
Automating the source selection process
[AD-P002835] N84-23380
Increasing the Contractor/Subcontractor/Vendor bidding lists
[AD-P002836] N84-23381
Selection of multiple sources in weapon systems acquisition
[AD-P002837] N84-23382
The Score technique: An analytical approach for assessing the results of manufacturing reviews
[AD-P002838] N84-23383

GOVERNMENT/INDUSTRY RELATIONS
Closing the gap between R and D and application in academe to better support government and industry
[AD-P002761] N84-23308
Cost accounting standards: A time for government and industry action
[AD-P002767] N84-23314
Government - contractor interaction
[AD-P002768] N84-23315
Needed help for the Federal Acquisition Regulation Council
[AD-P002769] N84-23316
Analysis of incentives for productivity-enhancing investment
[AD-P002770] N84-23317
The industrial modernization incentives program: An experimental effort to improve defense contractor productivity
[AD-P002771] N84-23318
The government relationship to industry in technology transfer and development
[AD-P002772] N84-23319
Contractor 'Hungriness' and the relative profitability of DoD business
[AD-P002796] N84-23342
Two-step industrial preparedness planning: Balancing funds and production capability
[AD-P002802] N84-23348
Readiness planning in a peacetime environment
[AD-P002803] N84-23349
Policy initiatives to achieve readiness and support objectives
[AD-P002804] N84-23350
Contractor fraud: Government response
[AD-P002833] N84-23378

GRADIENTS
Implementation of an optimal multicommodity network flow algorithm based on gradient projection and a path flow formulation
[AD-A138935] N84-23154

GRAFTING
Chemical properties and film casting of radiation grafted ion-containing polymers
[AD-A138551] N84-22754

GRAPH THEORY
Attitude and shape control of large space structures N84-23091
Connectivity of circulant digraphs
[MC-BW-186/83] N84-23220
Hereditary subdirect irreducibility in graphs
[MC-ZW-193/83] N84-23221

GRAPHITE-EPOXY COMPOSITES
Select fiber composites for space applications: A mechanistic assessment
[NASA-TM-83631] N84-22702
Matrix-dominated time-dependent deformation and damage of graphite/epoxy composite experimental data under creep and recovery
[AD-A139064] N84-22704
Large deformation behavior of long shallow cylindrical composite panels
[NASA-CR-173286] N84-22975

GRAVITATIONAL EFFECTS
Ode to gravity: Depth/diameter for fresh craters on Mercury N84-23470

GRAVITY ANOMALIES
Application of Magsat lithospheric modeling in South America. Part 1: Processing and interpretation of magnetic and gravity anomaly data
[E84-10115] N84-23008
Geodetic use of GEOSAT-A
[AD-A137993] N84-23048
Elysium Region, Mars: Characterization of tectonic features N84-23534

GRAZING INCIDENCE
The study of the physics of cometary nuclei
[NASA-CR-173519] N84-23543

GRIT
Grit blasting a distributed roughness based on a 30% probability of exceedance
[AD-A138779] N84-22809

GROOVES
The erosion of streamlined islands, longitudinal grooves and scour marks: Implications to the origin of the Martian outflow channels N84-23504

GROUND WATER
Scientific activity in hydrology, 1979-1982 N84-23010

GROUND WIND
WNDCOM: Estimating surface winds in mountainous terrain
[PB84-157700] N84-23083

GROUP THEORY
Annals of the Fourier Institute, volume 33, no. 4
[ISSN-0373-0956] N84-23172
On the Z sub 2 extensions of an imaginary quadratic field N84-23173
Formal and group Picard localization N84-23174
Cohomology of the 3-differentiable of the Poisson algebra of a symplectic manifold N84-23175

GUN PROPELLANTS
Multi-dimensional, multiphase flow analysis of flamespreading in a stick propellant charge N84-22663
Slotted stick propellant study N84-22664
Closed vessel combustion studies of stick propellant N84-22665
closed bomb combustion simulation of Hivelite solid propellant N84-22667
Effect of fabrication techniques on consolidated charge burning N84-22668
Expanded ignition effectiveness tests of selected igniter materials with Navy propellants N84-22671
Convective heating of energetic materials N84-22672
Molecular dynamics of propellant gases N84-22674
The thermodynamics of real and unreal black powder N84-22675
Investigation of organic oxidizers for high performance low flame temperature gas generator applications N84-22676
Ignitibility studies of LOVA propellants --- low vulnerability gun propellants N84-22678
Multiphase flow analysis of the ballistic performance of an anomalous LOVA propellant mix N84-22679

GUNNERY TRAINING
Skunkworks 81 revisited: An update on acquisition strategy
[AD-P002759] N84-23306

GUNS (ORDNANCE)
Liquid propellant ignition studies N84-22670
Molecular dynamics of propellant gases N84-22674

H

H ALPHA LINE
H alpha and TiO band observations of RS CVn stars N84-23410

HAITI
Cenozoic tectonics of the Caribbean: Structural and stratigraphic studies in Jamaica and Hispaniola N84-23062

HALIDES
Intramolecular electron transfer at metal surfaces. 1. Relative energetics of some corresponding outer- and inner-sphere pathways involving halide and pseudohalide bridging ligands
[AD-A139021] N84-22716

HALOGENATION
Electronically excited products in the reactions of O(3PJ) atoms with halogenated ethenes
[MPIS-8/1983] N84-23244

HARMONIC OSCILLATION
Calculation of apparent masses in blade ring N84-22793

HAWAII
The 1950 sulfur flow of Mauna Loa: Considerations for Io N84-23479
Effusion rate, length, and area relationships for some lava flows on Hawaii and Mount Etna with planetary implications N84-23482
Thermal infrared analysis of volcanic surfaces: Mars and Hawaii N84-23524

HAZE
The effect of haze on an operator's visual field and his target detection performance
[AD-A138330] N84-23099

HAZE DETECTION
Yellow ophthalmic filters in the visual acquisition of aircraft
[AD-A138536] N84-23097

HEAT EXCHANGERS
USSR report: Engineering and equipment
[JPRS-UEQ-84-004] N84-22772
Heat/mass flow enhancement design for a metal hydride assembly, phase 2
[DE84-007182] N84-22920

HEAT OF FUSION
Measurement of melt line penetration and heat flux during arc spot welding
[DE84-002013] N84-22962

HEAT OF VAPORIZATION
Measurement of melt line penetration and heat flux during arc spot welding
[DE84-002013] N84-22962

HEAT PUMPS
Heat/mass flow enhancement design for a metal hydride assembly, phase 2
[DE84-007182] N84-22920

HEAT RESISTANT ALLOYS
The future for titanium and superalloys --- in aircraft engines
[PNR-90175] N84-22742
The cyclic behaviour of a powder Ni-base superalloy --- aircraft engines
[PNR-90182] N84-22743

HEAT TRANSFER
Tip cap for a rotor blade
[NASA-CASE-LEW-13654-1] N84-22560
Effect of rotation on thermal state of runner blade through effect on heat transfer on coolant side N84-22787
Hybrid perturbation/Bubnov-Galerkin technique for nonlinear thermal analysis
[NASA-TP-2145] N84-22907
Heat/mass flow enhancement design for a metal hydride assembly, phase 2
[DE84-007182] N84-22920
Instrumentation for sensing moisture content of material using a transient thermal pulse
[NASA-CASE-NPO-15494-2] N84-22935
Heat pipes to reduce engine exhaust emissions
[NASA-CASE-LEW-12590-1] N84-22958
Measurement of melt line penetration and heat flux during arc spot welding
[DE84-002013] N84-22962

HEAT TRANSMISSION
Modeling Io volcanism: Maximum volcanic temperatures, depths of melting and magma composition N84-23436

HEAT TREATMENT
The heat treatment response of thermomechanically processed M-50 steel
[AD-A138571] N84-22736

HEAVY IONS
RFQ development at LBL
[DE84-006762] N84-23271

HELICOPTER ENGINES
Helicopter engine technology with particular reference to the Rolls-Royce Gem engine
[PNR-90193] N84-22578

HELICOPTERS
Detection of horizontal bars as a function of length, separation, eccentricity and frequency of temporal modulation: Possible applications to helicopter acquisition
[BAE-BT-11268] N84-23105
User manual for driver program
[AD-A139028] N84-23156

HELIOSTATS
Thermodynamic model for a central receiver of a solar plant with partial shading of the heliostat field
[ESA-TT-807] N84-23034

HELIUM-NEON LASERS
Utilizing light focusing by gas discharge medium for stabilization of emission power of He-Ne laser at wavelength of 6401 angstroms N84-22779

HELMHOLTZ RESONATORS
Acoustic ground impedance meter
[NASA-CASE-LAR-12995-1] N84-22933

HELMHOLTZ VORTICITY EQUATION
Vortex motion in a precombustion chamber with intersecting jets
[AD-A139040] N84-22717
Observation of surface-enhanced Raman scattering for transition-metal hexaammine cations at the outer Helmholtz plane: Implications for enhancement mechanisms at electrochemical interfaces
[AD-A139045] N84-22719

HETEROJUNCTIONS
Characterization of single crystal Cu/sub 2S/CdS heterojunctions by hing resolution electron microscopy
[DE84-006761] N84-23287

HF LASERS
Pulsed D2-F2 chain-laser damage to coated window and mirror components
[AD-A138911] N84-22950

HIERARCHIES
Dynamic, hierarchical decision problems
[AD-P002912] N84-22883
The simple roots of real-time computation hierarchies (preliminary version)
[MC-RW-244/83] N84-23203
HIGH FREQUENCIES
Direct measurement of high frequency solid propellant response functions N84-22849
Development of high frequency low weight power magnetics for aerospace power systems
[NASA-TM-83656] N84-22892
Method of and apparatus for double-exposure holographic interferometry
[NASA-CASE-MFS-25405-1] N84-22929
HIGH PRESSURE
Cathode degradation and erosion in high pressure arc discharges
[NASA-TM-83638] N84-22631
Investigation of combustion characteristics of a high chamber pressure rocket motor N84-22693
High pressure melting and crystallization of Nylon-11
[AD-A138658] N84-22760
Theoretical predictions for the phase stability of dense binary mixtures N84-23428
HIGH RESOLUTION
High angular resolution microwave sensing with large, sparse, random arrays
[AD-A138717] N84-22874
High resolution ultrasonic densitometer
[DE84-003387] N84-22939
Characterization of single crystal Cu/sub 2S/CdS heterojunctions by hing resolution electron microscopy
[DE84-006761] N84-23287
A normal incidence, high resolution X-ray telescope for solar coronal observations
[NASA-CR-173518] N84-23412
Shock waves and mass outflow in the Orion molecular cloud: Observations of far-infrared emission lines of carbon monoxide, hydroxyl and ammonia N84-23423
High-resolution color images of Io N84-23446
HIGH SPEED PHOTOGRAPHY
An investigation of experimental techniques for obtaining particulate behavior in metallized solid propellant combustion N84-22659
HIGH STRENGTH
Development of high strength braze joints in beryllium
[DE84-007243] N84-22964
HIGH TEMPERATURE PLASMAS
Physics of high temperature, dense plasmas
[AD-A138872] N84-23268
HMX
Condensed phase temperature profiles in deflagrating HMX N84-22657
Deuterium isotope effects in HMX thermochemical mechanisms: Decomposition, deflagration, and combustion N84-22680
Kinetics of the Beta + Delta phase transformation of HMX N84-22681
Modeling the self-deflagration of HMX N84-22682
Combustion thermodynamics of some boron-nitrogen-hydrogen compounds N84-22684
HOLE GEOMETRY (MECHANICS)
The application of cold worked holes (in aircraft structures)
[NLR-TR-81120-U] N84-22990
HOLES (ELECTRON DEFICIENCIES)
Geometric rationale for hydrogenated Pd3P/sub 1-x
[DE84-006737] N84-23268
HOLLOW CATHODES
Hollow cathode cell for pulsed lasers using metal vapors and their chemical compounds N84-22778
HOLOGRAPHIC INTERFEROMETRY
Method of and apparatus for double-exposure holographic interferometry
[NASA-CASE-MFS-25405-1] N84-22929
Development of holographic interferometry for welding arc analysis
[DE84-005454] N84-22940
HOLOGRAPHY
An investigation of experimental techniques for obtaining particulate behavior in metallized solid propellant combustion N84-22659
Infrared optics: Holographic and surface relief devices
[BAE-BT-11393] N84-23249
HOMOLOGY
Cohomology of the 3-differentiable of the Poisson algebra of a symplectic manifold N84-23175
HORIZONTAL FLIGHT
V/STOL manauverability and control
[NASA-TM-85939] N84-22584
HORIZONTAL ORIENTATION
Plane motion of solid body on rough surface of annular bearing rotating about its axis perpendicular to plane of motion N84-22801
HOT WORKING
A review of advanced manufacturing technology — gas turbine components
[PNR-90194] N84-22815
HOUSEKEEPING (SPACECRAFT)
Space Station Systems Technology Study. Volume 1: Executive summary
[NASA-CR-171014] N84-22614
HUMAN BODY
Effects of a negative G strap on restraint dynamics and human impact response
[AD-A138642] N84-23121
HUMAN FACTORS ENGINEERING
A man-machine interface concept for a state-of-art, shipboard, command/control console
[AD-P002894] N84-22854
Human factors aspects of C3 systems — command, control, communication (C3)
[PP-119] N84-23115
Numeric keyboard layout and computer menu selection
[BAE-BT-11989] N84-23116
Human factors in space telepresence
[NASA-CR-173420] N84-23119
USSR report: Science and technology policy
[JPRS-UST-84-007] N84-23391
Research in man-machine interaction discussed N84-23393
HUMAN PERFORMANCE
En route/terminal ATC (Air Traffic Control) operations concept
[AD-A138991] N84-22550
Human decisionmaking in dynamic environments with increasing information processing demands
[AD-P002884] N84-22845
Individual differences in military decisionmaking: The classification performance of active sonar operators
[AD-P002885] N84-22846
Decision and display analysis in a simple surveillance problem
[AD-P002886] N84-22847
Yellow ophthalmic filters in the visual acquisition of aircraft
[AD-A138536] N84-23097
Detection of horizontal bars as a function of length, separation, eccentricity and frequency of temporal modulation: Possible applications to helicopter acquisition
[BAE-BT-11288] N84-23105
Modelling of visual search performance
[BAE-BT-14586] N84-23106
Detection of dotted forms in a structured visual noise environment
[AD-A138853] N84-23108
Personnel technology: Performance appraisal, a process approach
[AD-A138359] N84-23112
HUMAN RESOURCES
Report of the DOD-University forum working group on engineering and science education
[AD-A138205] N84-23292
The leader of the Army acquisition workforce
[AD-P002762] N84-23309
Prerequisites for the establishment of a professional acquisition workforce
[AD-P002763] N84-23310
Training requirements for changing times
[AD-P002764] N84-23311
HUMIDITY MEASUREMENT
Characterization of humidity sensors and physical properties of h20
[AD-A139024] N84-22938
HYDRAULIC CONTROL
Analysis of the transfer function model of tray-type binary distillation columns with liquid hydraulic delay
[RR-234] N84-22816
HYDRAULIC TEST TUNNELS
Experimental observations of vortex ring interaction with the fluid adjacent to a surface
[AD-A138999] N84-22917
HYDROCARBON FUELS
Mechanism of soot formation in preximed C2H2/O2 flames N84-22727
Alternate fuels combustion research
[AD-A138575] N84-22769
HYDRODYNAMIC EQUATIONS
Effect of hydromechanical inertia forces on stability of cylindrical hydrodynamic bearing N84-22789
HYDRODYNAMICS
Rocket motor aeroacoustics N84-22642
Fluid-dynamically coupled solid propellant combustion instability - cold flow simulation N84-22644
USSR report: Engineering and equipment
[JPRS-UEQ-84-004] N84-22772
Hydrodynamic theory of convective transport across a dynamically stabilized diffuse boundary layer — plasma flow
[JUEL-1869] N84-23275
HYDROGEN
Theoretical calculation of H/sub 2 S- and Q-branch spectra for propellant flames N84-22636
HYDROGEN EMBRITTLEMENT
On the limiting electrode potential in cavities and its role in deciding between SCC (Stress Corrosion Cracking) and HC (Hydrogen Cracking) in metals
[AD-A138585] N84-22713
HYDROGEN OXYGEN FUEL CELLS
Design considerations for a 10-kW integrated hydrogen-oxygen regenerative fuel cell system
[NASA-TM-83664] N84-23023
HYDROGEN PRODUCTION
Study of systems and technology for liquid hydrogen production independent of fossil fuels
[NASA-CR-173422] N84-22768
HYDROGENATION
Geometric rationale for hydrogenated Pd3P/sub 1-x
[DE84-006737] N84-23268
HYDROGEOLOGY
Fluvial drainage systems: Margaritifer Sinus and Agyre (NC, NE) quadrangles, Mars N84-23497
A regression model for the temporal development of soil pipes and associated gullies in the alluvial-fill valley of the Rio Puerco, central New Mexico N84-23502
Experiments examining the shapes of isolated bars in comparison with those occurring in braided rivers N84-23503
The erosion of streamlined islands, longitudinal grooves and scour marks: Implications to the origin of the Martian outflow channels N84-23504
HYDROLOGY
LANDSAT-D investigations in snow hydrology
[E84-10094] N84-22997
Atmospheric model development N84-22998
Scientific activity in hydrology, 1979-1982 N84-23010
Incorporation of remotely sensed soil moisture data into a hydrologic runoff model N84-23017
HYDROLYSIS
Hydrolytic degradation of Kevlar 49 fibers
[DE84-004158] N84-22705
Hydrolytic degradation of kapton film
[AD-A139016] N84-22762
HYDROSTATICS
Solving statics problems of thick-walled cylindrical shells with loose contact between layers N84-22805
Work capsule for lightweight hydrostatic machines
[CSIR-RR-581] N84-22905
HYDROXIDES
Ultraviolet OH emissions in H2-air diffusion flames N84-22629
Kinetic studies of atmospheric reactions of OH radicals N84-23050
Kinetics and products of the reaction OH + HNO3 N84-23051
HYPERSONIC FLOW
Theory of hypersonic three-dimensional flow of nonsteady gas stream with relaxation past thin wing with arbitrary aspect ratio N84-22791
Interaction of unsteady spatial boundary layer with hypersonic flow near rapidly heated portion of surface N84-22794
Hypersonic flow around flat body in case of intense radiative heat exchange N84-22795
HYPERSONIC SPEED
Optimal maneuvers of orbital transfer vehicles N84-22606
HYPERVELOCITY IMPACT
Progressive impact cratering N84-23469
HYPSOGRAPHY
Hypsometric studies of Mars. N84-23530

I

IAPETUS
Voyager feature-fixed photometry of Iapetus N84-23440
Geologic studies of outer solar system satellites: Iapetus and Europa N84-23448
ICE
Ice-covered volcanic water flows on Ganymede N84-23432
Photometry of icy satellites: How important is multiple scattering in diluting shadows? N84-23438
Comparison of Hapke's photometric theory with Voyager observations of Europa, Enceladus, Rhea and Mimas N84-23439
Voyager feature-fixed photometry of Iapetus N84-23440
Cometary nucleus and active regions N84-23450

Morphology of fresh craters on Ganymede and the origin of pedestal craters N84-23466
Permafrost on Mars: distribution, formation, and geological role N84-23506

ICELAND
Analysis of production data from the Krafla geothermal field, Iceland [DE84-006861] N84-23014
Planetary geomorphology field studies: Iceland and Antarctica N84-23514

IDAHO
East Butte: A volcanic dome of the Eastern Snake River Plain, Idaho N84-23475

IDEAL GAS
Discharge of ideal gas into vacuum N84-22785

IGNEOUS ROCKS
East Butte: A volcanic dome of the Eastern Snake River Plain, Idaho N84-23475

IGNITERS
Liquid propellant ignition studies N84-22670
Expanded ignition effectiveness tests of selected igniter materials with Navy propellants N84-22671
Ignitibility studies of LOVA propellants — low vulnerability gun propellants N84-22678

IGNITION
Device and method for frictionally testing materials for ignitability [NASA-CASE-MSC-20622-1] N84-22596
The 20th JANNAF Combustion Meeting, volume 1 [AD-A138033] N84-22632
Liquid propellant ignition studies N84-22670
Convective heating of energetic materials N84-22672
Effect of O2 on double-base propellant ignition N84-22673
Very low thrust gaseous oxygen-hydrogen rocket engine ignition technology N84-22692
Options for an ignited tokamak [DE84-007927] N84-23272

IGNITION SYSTEMS
Liquid propellant ignition studies N84-22670

IMAGE ENHANCEMENT
Flash X-ray with image enhancement applied to combustion events N84-22666

IMAGE PROCESSING
Compression algorithm for data analysis in a radio link (preparation of PACEM 2 experiment) [CRPE-NT-121] N84-22881
LANDSAT-D investigations in snow hydrology [E84-10094] N84-22997
Registration of TM data to digital elevation models N84-22999
LANDSAT 4 investigations of Thematic Mapper and multispectral scanner applications — Death Valley, California; Silver Bell Copper Mine, Arizona, and Dulles Airport near Washington, D.C. [E84-10100] N84-23003
The Pennsylvania defoliation application pilot test [E84-10111] N84-23004
LANDSAT 4 band 6 data evaluation [E84-10119] N84-23009
A potentially powerful method of simple automatic recognition exhibiting scale and orientation independance — image processing [BAE-BT-11088] N84-23102
Some considerations of forms and distributions of receptive field units in early visual processing [BAE-BT-11177] N84-23103
A high speed processor for binary images [AD-A138908] N84-23125
Image acquisition and manipulation system [AD-A138927] N84-23153
Image compression: A 2-dimensional run-length coding N84-23162
Comparison of processor arrays with pipeline processors for image processing [NLR-MP-83011-U] N84-23165
Adaptive hybrid picture coding [AD-A138876] N84-23184
Feasibility studies of optical processing of image bandwidth compression schemes [AD-A138736] N84-23254
Photometry of icy satellites: How important is multiple scattering in diluting shadows? N84-23438
Comparison of Hapke's photometric theory with Voyager observations of Europa, Enceladus, Rhea and Mimas N84-23439
High-resolution color images of Io N84-23446
Short time-scale surface changes on Io N84-23447
Multi-image photometric solutions for the Galilean satellites N84-23522
Rapid extraction of relative topography from Viking orbiter images. 2: Application to irregular topographic features N84-23523
The Galilean Satellite Geological Mapping Program, 1983 N84-23541

IMAGE RESOLUTION
Galilean satellite multispectral data base production N84-23521

IMIDES
Polyphenylene ethers with imide linking groups [NASA-CASE-LAR-12980-1] N84-22749

IMPACT DAMAGE
Geologic studies of outer solar system satellites: Iapetus and Europa N84-23448
Recent comet impacts on the moon: The evidence from spectral reflectance studies N84-23453
Martian crater size distributions and terrain age N84-23462
Impact of Upheaval Dome, Utah N84-23465

IMPACT RESISTANCE
Qualities of SEP ceramic-ceramic Cerasep composites N84-23225

IMPACT STRENGTH
Development of an impact resistant test method for polycarbonate [AD-A139082] N84-22988

IMPACT TESTS
Development of an impact resistant test method for polycarbonate [AD-A139082] N84-22988
Effects of a negative G strap on restraint dynamics and human impact response [AD-A138642] N84-23121

IMPEDANCE
Low noise tuned amplifier [NASA-CASE-GSC-12567-1] N84-22887

IMPLANTATION
The development and fabrication of an implantable, multiplexed, semiconductor multielectrode array [AD-A138788] N84-22895

IMPURITIES
Deep level impurities in germanium and silicon: Low temperature passivation or removal techniques [DE84-006772] N84-23286

INCENTIVE TECHNIQUES
USSR report: Science and technology policy [JPRS-UST-84-004] N84-23387

INCIDENCE
A normal incidence, high resolution X-ray telescope for solar coronal observations [NASA-CR-173518] N84-23412

INCOHERENCE
Multi-sensor array time-delay estimation with small phase incoherences [AD-A138867] N84-23183

INCOHERENT SCATTERING
Optical gas temperature measurement in gas turbines [PNR-90174] N84-22572
Calm ionospheric dynamo. Part 1: Simulations carried out in 1981 [CRPE-NT-112-PT-1] N84-23055

INCOMPRESSIBLE FLOW
Calculation of the flow over a stalled airfoil N84-22531

INCONEL (TRADEMARK)
Ceramic-to-metal bonding for pressure transducers [NASA-CR-173500] N84-22753

INDEPENDENT VARIABLES
Dependence of hydromagnetic energy spectra on interplanetary parameters [AD-A138745] N84-23209

INDEXES (DOCUMENTATION)
NASA Thesaurus supplement. Part 1: Hierarchical listing [NASA-SP-7051(SUPPL-1)] N84-23396
Documentation for the machine-readable version of the SAO-HD-GC-DM cross index version 1983 [NASA-TM-85570] N84-23418
Documentation for the machine-readable version of the Smithsonian Astrophysical Observatory Star catalogue (SAO) version 1984 [NASA-TM-85574] N84-23419

INDIUM PHOSPHIDES
InP materials [AD-A138992] N84-23282

INDONESIA
Depositional history and structural evolution of a sedimentary basin in a modern forearc setting, western Sunda Arc, Indonesia N84-23068

INDUCTION
Bellows flow-induced vibrations [NASA-TM-82556] N84-22912

INDUCTION MOTORS
Three phase power factor controller [NASA-CASE-MFS-25535-2] N84-22885
Motor power control circuit for ac induction motors [NASA-CASE-MFS-25323-1] N84-22886

INDUSTRIAL MANAGEMENT
Cost accounting standards: A time for government and industry action [AD-P002767] N84-23314
The industrial modernization incentives program: An experimental effort to improve defense contractor productivity [AD-P002771] N84-23318
The government relationship to industry in technology transfer and development [AD-P002772] N84-23319
USSR report: Science and technology policy [JPRS-UST-84-004] N84-23387
Computer developments at Institute of Automation and Electrometry described N84-23390

INDUSTRIAL PLANTS
Model reference adaptive control systems: The hybrid approach N84-23169

INDUSTRIES
Problems of prompt adoption of new technology discussed N84-23396

INEQUALITIES
On a fundamental inequality and the singularities of an analytic function defined by the LC-Dirichletian element N84-23177
An interpolation type inequality for a discrete weighted norm [CTH-MATH-1983-30] N84-23213

INFESTATION
The Pennsylvania defoliation application pilot test [E84-10111] N84-23004

INFINITE SPAN WINGS
Excitation of Tollmin-Schlichting waves in boundary layer at vibrating surface of infinite-span sweptback wing N84-22792

INFINITY
Big omega versus the wild functions [MC-IW-239/83] N84-23200

INFORMATION
Information theoretic models of memory in human decisionmaking models [AD-P002883] N84-22844

INFORMATION DISSEMINATION
Matrix-dominated time-dependent deformation and damage of graphite/epoxy composite experimental data under creep and recovery [AD-A139064] N84-22704
Toward a theory of library and information science N84-23405
Strategies and mechanisms for the diffusion of scientific and technical information: A comparative study N84-23406
Documentation for the machine-readable version of the catalogue of 20457 Star positions obtained by photography in the declination zone -48 deg to -54 deg (1950) [NASA-TM-85572] N84-23416
Documentation for the machine-readable version of a table of Redshifts for Abell clusters (Sarazin, Rood and Struble 1982) [NASA-TM-85571] N84-23417
Documentation for the machine-readable version of the SAO-HD-GC-DM cross index version 1983 [NASA-TM-85570] N84-23418

INFORMATION FLOW
Human factors aspects of C3 systems — command, control, communication (C3) [PP-119] N84-23115
Toward a theory of library and information science N84-23405
Strategies and mechanisms for the diffusion of scientific and technical information: A comparative study N84-23406

INFORMATION MANAGEMENT
Strategies and mechanisms for the diffusion of scientific and technical information: A comparative study N84-23406

INFORMATION RETRIEVAL
Information theoretic models of memory in human decisionmaking models [AD-P002883] N84-22844
The use of a small digital computer for on-line behavioral experiments [AD-A138975] N84-23126

INFORMATION SYSTEMS
An evaluation of ARIADNE (alternative ranking interactive aid based on dominance structure information elicitation) [AD-P002891] N84-22852
A man-machine interface concept for a state-of-art, shipboard, command/control console [AD-P002894] N84-22854
Multi-sensor fusion, communications and information warfare [AD-P002895] N84-22855
The design of information structures: Basic allocation strategies for organizations [AD-P002909] N84-22861
The microcomputer in the acquisition environment [AD-P002748] N84-23295

Toward a theory of library and information science N84-23405

INFORMATION THEORY
Information processing and decisionmaking organizations: A mathematical description [AD-P002978] N84-22839
Information theoretic models of memory in human decisionmaking models [AD-P002863] N84-22844
The effects of a spatial information format on decision making performance in a C3 (Command, Control, and Communications) probabilistic information integration task [AD-P002687] N84-22848
A knowledge based interactive procedure for planning and decision support under uncertainty and parameter imprecision [AD-P002690] N84-22851
An evaluation of ARIADNE (alternative ranking interactive aid based on dominance structure information elicitation) [AD-P002691] N84-22852
Informational aspects of a class of subjective games of incomplete information [AD-P002910] N84-22862
Toward a theory of library and information science N84-23405
Strategies and mechanisms for the diffusion of scientific and technical information: A comparative study N84-23406

INFORMATION TRANSFER
Strengthening small business participation in Department of Defense extramural research and development [AD-P002832] N84-23377

INFRARED ASTRONOMY
Far-IR spectroscopy of the galactic center: Neutral and ionized gas in the central 10 pc of the galaxy [NASA-CR-166510] N84-23411
Infrared astronomy research and high altitude observations [NASA-CR-173526] N84-23413
Publications resulting from Infrared Astronomy Research and High Altitude Observations [NASA-CR-173525] N84-23414

INFRARED ASTRONOMY SATELLITE
Reprogrammable onboard mission of IRAS [NLR-MP-83014-U] N84-22600

INFRARED DETECTORS
Signal processing circuit development [AD-A138648] N84-22870
Infrared temperature measurements in combustion systems [PNR-90170] N84-22942

INFRARED IMAGERY
Estimating monthly rainfall from geostationary satellite imagery over Amazonia, Brazil N84-23089

INFRARED RADIATION
Aircraft exhaust plume signature predictions for non-axisymmetric multiple engine installations N84-22627
Theoretical predictions of excitation cross sections for collisions of HF, HCl, CO, H2O, and CO2 with O(P-3) N84-22630
Infrared temperature measurements in combustion systems [PNR-90170] N84-22942
Shock waves and mass outflow in the Orion molecular cloud: Observations of far-infrared emission lines of carbon monoxide, hydroxyl and ammonia N84-23423

INFRARED SPECTRA
LANDSAT 4 band 6 data evaluation [E84-10119] N84-23009
Near millimeter wave action in n-GaAs [AD-A138602] N84-23252
Far-IR spectroscopy of the galactic center: Neutral and ionized gas in the central 10 pc of the galaxy [NASA-CR-166510] N84-23411
Surface compositions in the Aristarchus Region: Implications for regional stratigraphy N84-23519
Thermal infrared analysis of volcanic surfaces: Mars and Hawaii N84-23524

INFRARED SPECTROMETERS
Investigations of radical-radical reactions using a far infrared Laser Magnetic Resonance (Fir-LMR) spectrometer [MPIS-4/1983] N84-22730
Shock waves and mass outflow in the Orion molecular cloud: Observations of far-infrared emission lines of carbon monoxide, hydroxyl and ammonia N84-23423

INFRARED SPECTROSCOPY
Deformation studies of polymers by Fourier transform infrared spectroscopy N84-22751
The 1983 International Conference on Fourier Transform Spectroscopy September 1983 [AD-A139014] N84-23258
Far-IR spectroscopy of the galactic center: Neutral and ionized gas in the central 10 pc of the galaxy [NASA-CR-166510] N84-23411
Recent comet impacts on the moon: The evidence from spectral reflectance studies N84-23453

INKS
Multicolor printing plate joining [NASA-CASE-LEW-13596-1] N84-22930

INLET FLOW
An experimental and analytic study of the flow subsonic wind tunnel inlets [AD-A138665] N84-22540
Numerical analysis of an unsteady shock in an inlet diffuser N84-22686
Bellows flow-induced vibrations [NASA-TM-82556] N84-22912

INSOLATION
Study of systems and technology for liquid hydrogen production independent of fossil fuels [NASA-CR-173422] N84-22768

INSTRUCTORS
Device 2E6 (ACMS) Air Combat Maneuvering Simulator instructor console review [AD-A138972] N84-22587

INTAKE SYSTEMS
An experimental and analytic study of the flow subsonic wind tunnel inlets [AD-A138665] N84-22540

INTEGRAL EQUATIONS
The changing scene in computational fluid dynamics [AD-A138661] N84-22914

INTEGRALS
Estimates of one-dimensional oscillatory integrals N84-23179

INTEGRATED CIRCUITS
Method for sequentially processing a multi-level interconnect circuit in a vacuum chamber [NASA-CASE-MFS-25670-1] N84-22884
Electrical, chemical, and microstructural characterization of gettering mechanisms for VLSI (Very Large Scale Integrated Circuits) [AD-A138662] N84-22893
Latchup window tests [AD-A138680] N84-22894
The synthesis and validation of experimental VLSI design using decoupled behavioral, structural and physical specifications N84-22902
Thomson semiconductors bipolar IC strategy to 1986 N84-23227
Fine line electromigration. The effect of crossed thermal gradients [AD-A138654] N84-23279

INTERFACES
Utility of surface reaction entropies for examining reactant-solvent interactions at electrochemical interfaces. Ferricinium-ferrocene attached to platinum electrodes [AD-A139055] N84-22722
A method for evaluating the surface concentrations of 2 like-charged ions simultaneously adsorbed at an electrode-solution interface [AD-A139074] N84-22724
Effect of interfacial bonding on the strength of adhesion of elastomers. 3: Interlinking by molecular entanglements [AD-A138760] N84-22757
Contact-stress analysis of elastic-viscoelastic interface conditions [AD-A138834] N84-22759
Development of a generalized human-machine interface [AD-P002888] N84-22849
A man-machine interface concept for a state-of-art, shipboard, command/control console [AD-P002894] N84-22854
Surface acoustic wave resonators in layered substrates with large electromechanical coupling coefficient N84-23230

INTERFACIAL TENSION
Matrix-dominated time-dependent deformation and damage of graphite/epoxy composite experimental data under creep and recovery [AD-A139064] N84-22704
An exactly solvable model for ideally polarizable interfaces [AD-A138719] N84-23182
The ideally polarizable interface: A solvable model and general sum rules [AD-A138720] N84-23207

INTERIOR BALLISTICS
Closed vessel combustion studies of stick propellant N84-22665
Flash X-ray with image enhancement applied to combustion events N84-22666
Multiphase flow analysis of the ballistic performance of an anomalous LOVA propellant mix N84-22679

INTERMOLECULAR FORCES
Intramolecular electron transfer at metal surfaces. 2: Comparisons of ligand-bridged CR(3) reduction kinetics at silver versus mercury electrodes [AD-A139047] N84-22720
Intramolecular electron transfer at metal surfaces. 3: Influence of bond conjugation on reduction kinetics of Cobalt (3) anchored to metal surfaces via thiophenecarboxylate ligands [AD-A139066] N84-23242

INTERNAL COMBUSTION ENGINES
Real time pressure signal system for a rotary engine [NASA-CASE-LEW-13622-1] N84-22559

INTERNAL WAVES
The effect of interior motion on seasonal thermocline evolution [AD-A138270] N84-23088

INTERNATIONAL COOPERATION
World Weather Watch: The plan and implementation program, 1984-1987 [WMO-617] N84-23078
New initiatives in international programs [AD-P002813] N84-23359

INTERNATIONAL MAGNETOSPHERIC STUDY
Observations of short period magnetic pulsations during the SBARMO-79 campaign: Data summary [REPT-90/1982] N84-23052
Quick-look tables of continuous pulsations (Pc1) and Intervals of Pulsations of Diminishing Periods (IPDP) magnetic pulsation events recorded in Finland during IMS years 1976-1979: Data summary [REPT-92/1982] N84-23053

INTERNATIONAL SUN EARTH EXPLORERS
Ongoing data reduction, theoretical studies and supporting research in magnetospheric physics [NASA-CR-173419] N84-23039

INTERNATIONAL TRADE
Export trade: Big business for the small entrepreneur [AD-P002811] N84-23357

INTERPLANETARY SPACECRAFT
Performance assessment of planetary missions as launched from an orbiting space station [NASA-CR-173498] N84-22594

INTERPOLATION
An interpolation type inequality for a discrete weighted norm [CTH-MATH-1983-30] N84-23213

INTERPROCESSOR COMMUNICATION
Distributed estimation in the MIT/LL (Massachusetts Institute of Technology/Lincoln Laboratory) DSN (Distributed Sensor Networks) test-bed [AD-P002897] N84-22856
Optimal file allocation problems for distributed data bases in unreliable computer networks, 2 [AD-P002913] N84-22864
Distributed elections in an Archimedean ring of processors (preliminary version) [MC-IW-243/83] N84-23202
Beyond the data base: Technology for information resource management [AD-A138640] N84-23402

INTERSYMBOLIC INTERFERENCE
Fast evaluation of the numerical error rate in the presence of intersymbolic interference [CRPE-NT-127] N84-23158

INVENTORIES
Central Demand Data Base (CDDB) End Item Code (EIC) [AD-P002807] N84-23353

INVENTORY MANAGEMENT
Mortality and spareparts: A conceptual analysis [AD-P002826] N84-23371

INVESTMENT CASTING
A review of advanced manufacturing technology — gas turbine components [PNR-90194] N84-22815

INVESTMENTS
Analysis of incentives for productivity-enhancing investment [AD-P002770] N84-23317

INVISCID FLOW
Analysis of inviscid and viscous flows in cascades with an explicit multiple-grid algorithm [NASA-TM-83636] N84-22527
Calculation of the flow over a stalled airfoil N84-22531
ALESEP: A computer program for the analysis of airfoil leading edge separation bubbles [NASA-CR-172310] N84-22537
Experimental observations of vortex ring interaction with the fluid adjacent to a surface [AD-A138999] N84-22917

IO
The Laplacian resonance and tidal dissipation N84-23434
The structure of the Ionian lithosphere N84-23435

Modeling Io volcanism: Maximum volcanic temperatures, depths of melting and magma composition N84-23436
Volcanic forms in the Kane Patera region, Io N84-23437
New models for landform evolution on Io N84-23443
High-resolution color images of Io N84-23446
Short time-scale surface changes on Io N84-23447
Classification of volcanoes of the Kane Patera Quadrangle of Io: Proportions of lava flows and pyroclastic flows N84-23477
The 1950 sulfur flow of Mauna Loa: Considerations for Io N84-23479
Geologic investigations of outer planets satellites [NASA-CR-173497] N84-23544
A summary of whistlers observed by Voyager 1 at Jupiter [NASA-CR-173415] N84-23545

ION BEAMS
Modification of the near surface region metastable phases and ion induced reactions [AD-A138642] N84-22694
Method of making an ion beam sputter-etched ventricular catheter for hydrocephalus shunt [NASA-CASE-LEW-13107-2] N84-23095
Formation of negative ions by charge transfer: He(-) to Cl(-) [DE84-005718] N84-23243

ION CYCLOTRON RADIATION
External excitation of ion cyclotron drift waves in a two-ion species plasma [IPPJ-685] N84-23264

ION ENGINES
Cathode degradation and erosion in high pressure arc discharges [NASA-TM-83638] N84-22631

ION EXCHANGE RESINS
Chemical properties and film casting of radiation grafted ion-containing polymers [AD-A138551] N84-22754

ION IMPLANTATION
Radiation damage and defect behavior in ion-implanted, lithium counterdoped silicon solar cells [NASA-TM-83646] N84-22890

ION INJECTION
RFQ development at LBL [DE84-006762] N84-23271

ION PLATING
Diamondlike flake composites [NASA-CASE-LEW-13837-1] N84-22695

ION SOURCES
Design and fabrication of a surface conversion negative ion source and an 80 keV pre-accelerator [DE84-006753] N84-23269

IONIZATION
Three-dimensional nonequilibrium viscous shock-layer flows over complex reentry vehicles N84-22543
Analysis of spacecraft charging, particle beams and geophysical data bases [AD-A138632] N84-22616

IONIZATION CHAMBERS
Modulated voltage metastable ionization detector [NASA-CASE-ARC-11503-1] N84-23093

IONIZED GASES
The beam-density effect on energy loss of a relativistic charged particle beam [AD-A139051] N84-23241
Far-IR spectroscopy of the galactic center: Neutral and ionized gas in the central 10 pc of the galaxy [NASA-CR-166510] N84-23411

IONOSPHERE
Rayleigh-Taylor instability in the presence of a stratified shear layer [AD-A138544] N84-23043
A middle latitude ionospheric model [CRPE-NT-114] N84-23049

IONOSPHERIC CURRENTS
Calm ionospheric dynamo. Part 1: Simulations carried out in 1981 [CRPE-NT-112-PT-1] N84-23055

IONOSPHERIC DISTURBANCES
Long wavelength limit of interchange instabilities [AD-A138943] N84-23047

IONOSPHERIC PROPAGATION
Propagation effects in satellite-based synthetic aperture radars [AD-A138681] N84-22873
Geodetic use of GEOSAT-A [AD-A137993] N84-23048

IONOSPHERIC SOUNDING
F-layer ionization patches in the polar cap [AD-A138633] N84-23044

IONS
A method for evaluating the surface concentrations of 2 like-charged ions simultaneously adsorbed at an electrode-solution interface [AD-A139074] N84-22724

IRON
Thermodynamics and kinetics of the gas phase and pack aluminide coating formation on iron and steel N84-23291

IRRADIANCE
Measurement and analysis of diffuse solar irradiance N84-23546

ISLANDS
Experiments examining the shapes of isolated bars in comparison with those occurring in braided rivers N84-23503
The erosion of streamlined islands, longitudinal grooves and scour marks: Implications to the origin of the Martian outflow channels N84-23504

ISOTOPE EFFECT
Deuterium isotope effects in HMX thermochemical mechanisms: Decomposition, deflagration, and combustion N84-22680

ISOTOPIC LABELING
The vertical redistribution of a pollutant tracer due to cumulus convection N84-23057

ITERATION
Data compression [AD-A138541] N84-23124

J

JAMAICA
Cenozoic tectonics of the Caribbean: Structural and stratigraphic studies in Jamaica and Hispaniola N84-23062

JAMMING
Research Trends in Military Communications [AD-A138229] N84-22621
Spread spectrum communication in jamming N84-22627
Jam-resistant tactical communications N84-22628
Applications of coding to spread spectrum communications N84-22629
Trends in convolutional coding N84-22630
Spread spectrum networks N84-22631
Spread spectrum data networks N84-22632
Generalized adaptive node concept N84-22633

JET ENGINES
Preliminary investigation of a two-zone swirl flow combustor [NASA-TM-83637] N84-22565
Engine affordability — aircraft engines [PNR-90178] N84-22574
The future for titanium and superalloys — in aircraft engines [PNR-90175] N84-22742
Manufacturing influence of design and its importance to successful automation — aircraft engines [PNR-90189] N84-22814
Nonlinear/transient rotor dynamics analysis N84-22977

JET MIXING FLOW
Preliminary investigation of a two-zone swirl flow combustor [NASA-TM-83637] N84-22565
Vortex motion in a precombustion chamber with intersecting jets [AD-A139040] N84-22717
Mixing of swirling flows and behavior of wet flows [AD-A138697] N84-22915

JFET
The development and fabrication of an implantable, multiplexed, semiconductor multielectrode array [AD-A138788] N84-22895

JOINING
Effect of interfacial bonding on the strength of adhesion of elastomers. 3: Interlinking by molecular entanglements [AD-A138760] N84-22757

JOINTS (JUNCTIONS)
Electromagnetic radiation and scattering from a system of conducting bodies interconnected by wires N84-22882
Development of high strength braze joints in beryllium [DE84-007243] N84-22964
Strength of bolted joints in laminated composites N84-22992

JOURNAL BEARINGS
Improved compliant hydrodynamic fluid journal bearing [NASA-CASE-LEW-13670-1] N84-22959

JUDGMENTS
Tactical decision aids which quantify judgment [AD-P002889] N84-22850
Personnel technology: Performance appraisal, a process approach [AD-A138359] N84-23112

JUPITER (PLANET)
The Galilean Satellite Geological Mapping Program, 1983 N84-23541
Relationships and tectonics of the Jg-7 quadrangle of Ganymede N84-23542
A summary of whistlers observed by Voyager 1 at Jupiter [NASA-CR-173415] N84-23545

JUPITER ATMOSPHERE
The reaction NH2 + PH3 yields NH3 + PH2: Absolute rate constant measurement and implication for NH3 and PH3 photochemistry in the atmosphere of Jupiter [NASA-TM-85063] N84-23430
A summary of whistlers observed by Voyager 1 at Jupiter [NASA-CR-173415] N84-23545

K

KEVLAR (TRADEMARK)
Preliminary results of the effects of sewing, packing and parachute deployment on material strength [DE84-006484] N84-22541
Hydrolytic degradation of Kevlar 49 fibers [DE84-004158] N84-22705
Modes of deformation and failure of Kevlar 49 fibers and composites [DE84-004162] N84-22706

KINETIC ENERGY
Energetics of vortex ring formation [AD-A138795] N84-22539
Condensed phase temperature profiles in deflagrating HMX N84-22657

KINETIC EQUATIONS
Plane motion of solid body on rough surface of annular bearing rotating about its axis perpendicular to plane of motion N84-22601

KINETICS
Nonlinear least-squares fitting of first-order rate coefficients comparison between the Gauss-Seidel method and Swain's kore program [AD-A139080] N84-23157

KINOFORM
Infrared optics: Holographic and surface relief devices [BAE-BT-11393] N84-23249

L

LABOR
Employment changes resulting from the award of contracts in labor surplus areas [AD-P002834] N84-23379

LAMINAR BOUNDARY LAYER
The changing scene in computational fluid dynamics [AD-A138661] N84-22914
Experimental observations of vortex ring interaction with the fluid adjacent to a surface [AD-A138999] N84-22917

LAMINAR FLOW
Energetics of vortex ring formation [AD-A138795] N84-22539
Transonic flow around protruding corner with free streamline N84-22796

LAMINAR HEAT TRANSFER
The calculation of the heat transfer associated with the injection of methane gas at the stagnation point of the dissociated boundary layer of the laminar air flow [AD-A139063] N84-22918

LAMINATES
Dependence of burning rate of AP-polymer sandwiches on thickness of the binder laminae N84-22653
Fire and heat resistant laminating resins based on maleimido substituted aromatic cyclotriphosphazenes [NASA-CASE-ARC-11428-1] N84-22697
Large deformation behavior of long shallow cylindrical composite panels [NASA-CR-173286] N84-22975

LAND ICE
Wind erosion and dune formation on high frozen bluffs N84-23493

LANDFORMS
Reports of planetary geology program, 1983 [NASA-TM-86246] N84-23431
Geomorphic clues to the Martian volatile inventory. 1: Flow ejecta blankets N84-23474
Dark streaks on talus slopes, Mars N84-23499
Glacial and periglacial landforms in Denmark: Scandinavian analogs for Martian features N84-23507
Curvilinear ground on Mars: The search for terrestrial analogs N84-23508

Temporal and spatial distribution of exhumed topography N84-23517

LANDSAT 4

Spectroradiometric calibration of the Thematic Mapper and multispectral scanner system
[E84-10098] N84-23000

In-flight absolute radiometric calibration of the Thematic Mapper — White Sands, New Mexico N84-23002

LANDSAT 4 investigations of Thematic Mapper and multispectral scanner applications — Death Valley, California; Silver Bell Copper Mine, Arizona, and Dulles Airport near Washington, D.C.
[E84-10100] N84-23003

LANDSAT 4 band 6 data evaluation
[E84-10119] N84-23009

LANDSAT 5

Spectroradiometric calibration of the Thematic Mapper and multispectral scanner system
[E84-10098] N84-23000

LANDSLIDES

The Corlu landslide: Analog to giant landslides on Mars N84-23513

Geomorphic clues to the Martian volatile inventory: Landslides N84-23516

LARGE SCALE INTEGRATION

Electrical, chemical, and microstructural characterization of gettering mechanisms for VLSI (Very Large Scale Integrated Circuits)
[AD-A138662] N84-22693

Testability of VLSI (Very Large Scale Integration) leakage faults in CMOS (Complementary Metal Oxide Semiconductor)
[AD-A138978] N84-23281

LARGE SPACE STRUCTURES

Definition of technology development missions for early space stations. Large space structures, phase 2, midterm review
[NASA-CR-171004] N84-22607

Application of control theory to large flexible structures using the independent modal-space control method N84-22617

Attitude and shape control of large space structures N84-23091

LASER APPLICATIONS

A review study of nondestructive test techniques for residual stresses in aircraft transparencies
[AD-A138930] N84-22555

The 20th JANNAF Combustion Meeting, volume 1
[AD-A138033] N84-22632

Advanced diagnostics for reacting flows N84-22637

An optical surface tracking device which determines a solid propellant's burning rate N84-22638

Compressibility of colloids. 2: Compressibility studies of tri-block non-ionic polymers in toluene and water solutions
[AD-A138736] N84-22755

Bibliography of Soviet Laser Developments, Number 63, January-February 1983
[AD-A138742] N84-22948

Anomalous laser induced bunch lengthening on the ACO storage ring free electron laser
[AD-A138814] N84-22949

Review of free electron laser theory and experiments
[DE84-007232] N84-22954

LASER DAMAGE

Pulsed D2-F2 chain-laser damage to coated window and mirror components
[AD-A138911] N84-22950

LASER DRILLING

Laser drilling of aero engine components
[PNR-90185] N84-22956

LASER FUSION

Television system for monitoring target position in laser thermonuclear fusion experiments N84-22781

Absolutely uniform illumination of laser fusion pellets
[AD-A138944] N84-22951

LASER OUTPUTS

Method of and apparatus for double-exposure holographic interferometry
[NASA-CASE-MFS-25405-1] N84-22929

Method and apparatus for coating substrates using a laser
[NASA-CASE-LEW-13526-1] N84-22944

An automated system for characterizing laser pulses
[AD-A138580] N84-22945

Absolutely uniform illumination of laser fusion pellets
[AD-A138944] N84-22951

Safety eye protection through use of fast acting optical switching
[AD-A138582] N84-23120

LASER SPECTROMETERS

Investigations of radical-radical reactions using a far infrared Laser Magnetic Resonance (Fir-LMR) spectrometer
[MPIS-4/1983] N84-22730

LASER SPECTROSCOPY

Computer controlled laser optoacoustic spectroscopy for trace gas analysis N84-22710

Current trends in atomic spectroscopy
[PB84-162957] N84-22732

LASER TARGET INTERACTIONS

Spectroscopic measurements of the Laser-HANE plasma
[AD-A138685] N84-22947

Introduction to the Laser-HANE experiment and summary of low-pressure interaction results
[AD-A138945] N84-22952

LASER TARGETS

Television system for monitoring target position in laser thermonuclear fusion experiments N84-22781

A novel X-ray backlighting method for Rayleigh-Taylor instability measurements on ablatively driven targets
[AD-A138644] N84-22937

LASER WELDING

Absolutely uniform illumination of laser fusion pellets
[AD-A138944] N84-22951

LASERS

Mixing of swirling flows and behavior of wet flows
[AD-A138697] N84-22915

Method of and apparatus for double-exposure holographic interferometry
[NASA-CASE-MFS-25405-1] N84-22929

Method and apparatus for coating substrates using a laser
[NASA-CASE-LEW-13526-1] N84-22944

Pulsed D2-F2 chain-laser damage to coated window and mirror components
[AD-A138911] N84-22950

LATTICES (MATHEMATICS)

Hereditary subdirect irreducibility in graphs
[MC-ZW-193/83] N84-23221

LAUNCHERS

Space probe/satellite ejection apparatus for spacecraft
[NASA-CASE-MFS-15429-1] N84-22609

LAVA

Volcanic forms in the Kane Patera region, Io N84-23437

Morphology of buried craters: Lava thickness estimates by simulated flooding N84-23471

Classification of volcanoes of the Kane Patera Quadrangle of Io: Proportions of lava flows and pyroclastic flows N84-23477

The 1950 sulfur flow of Mauna Loa: Considerations for Io N84-23479

Effusion rate, length, and area relationships for some lava flows on Hawaii and Mount Etna with planetary implications N84-23482

Ridges on basalt flows N84-23484

LEAKAGE

Testability of VLSI (Very Large Scale Integration) leakage faults in CMOS (Complementary Metal Oxide Semiconductor)
[AD-A138978] N84-23281

LEAST SQUARES METHOD

Nonlinear least-squares fitting of first-order rate coefficients comparison between the Gauss-Seidel method and Swain's kore program
[AD-A139060] N84-23157

A comparison of several alternatives to maximum likelihood for the Weibull distribution
[AD-A138721] N84-23208

LEBESGUE THEOREM

Poisson integrals of absolutely continuous and other measures
[CTH-MATH-1983-10] N84-23210

LEGAL LIABILITY

Nailing down the liability issue once and for all
[AD-P002777] N84-23324

Contractor fraud: Government response
[AD-P002833] N84-23378

LENS ANTENNAS

Study and design of a cylindrical lens array antenna for wideband electronic scanning
[AD-A138808] N84-22875

LIBRARIES

Image acquisition and manipulation system
[AD-A138927] N84-23153

LIE GROUPS

The Fourier Plancherel transform of the analytic Lie group. 1: Weyl algebras and differential operators N84-23176

LIFE (DURABILITY)

Mortality and spareparts: A conceptual analysis
[AD-P002826] N84-23371

LIFE CYCLE COSTS

A cost based acquisition planning model utilizing expert system concepts
[AD-P002783] N84-23330

LIFT

Model identification and parameter estimation of the power, lift, and drag of light aircraft from a single maneuver N84-22552

LIFT DRAG RATIO

Slotted variable camber flap
[NASA-CASE-LAR-12541-1] N84-22551

Optimal maneuvers of orbital transfer vehicles N84-22606

LIGANDS

Intramolecular electron transfer at metal surfaces. 1. Relative energetics of some corresponding outer- and inner-sphere pathways involving halide and pseudohalide bridging ligands
[AD-A139021] N84-22716

Carboranylmethylene-substituted phosphazenes and polymers thereof
[NASA-CASE-ARC-11370-1] N84-22750

LIGHT (VISIBLE RADIATION)

An automated system for characterizing laser pulses
[AD-A138580] N84-22945

LIGHT EMISSION

Power transfer for microwave discharges
[AD-A138868] N84-23267

LIGHT EMITTING DIODES

Production oriented 3-5 epitaxy
[BMFT-FB-T-83-286] N84-23290

LIGHT IONS

RFQ development at LBL
[DE84-006762] N84-23271

LIGHT MODULATION

Incorporation of a PROM spatial light modulator into a system for automatic target recognition and tracking — Pockels Readout Optical Modulator (PROM)
[BAE-BT-12841] N84-23250

LIGHT SOURCES

Current trends in atomic spectroscopy
[PB84-162957] N84-22732

LIGHT TRANSMISSION

Light transmitting window assembly
[NASA-CASE-MSC-18417-1] N84-23251

LIKELIHOOD RATIO

Variable selection in heteroscedastic discriminant analysis
[CSIR-TWISK-283] N84-23171

LIMB DARKENING

Multi-image photometric solutions for the Galilean satellites N84-23522

LINE SPECTRA

Time-resolved spectrophotometry of the nova-like cataclysmic variables RW trianguium and UX Ursa Majoris N84-23408

Infrared astronomy research and high altitude observations
[NASA-CR-173526] N84-23413

Publications resulting from Infrared Astronomy Research and High Altitude Observations
[NASA-CR-173525] N84-23414

LINEAR ACCELERATORS

Design and fabrication of a surface conversion negative ion source and an 80 keV pre-accelerator
[DE84-006753] N84-23269

LINEAR EQUATIONS

On the oscillatory flowfield in solid rocket motors N84-22645

LINEAR PROGRAMMING

Optimal file allocation problems for distributed data bases in unreliable computer networks, 2
[AD-P002913] N84-22864

LINEAR SYSTEMS

Linear dynamics of cables and chains N84-22978

An introduction to adjoint techniques
[BAE-BT-11172] N84-23170

Symmetric systems with semisimple structure algebra: The quaternionic case
[NASA-CR-173421] N84-23193

LINES (GEOMETRY)

Detection of dotted forms in a structured visual noise environment
[AD-A138853] N84-23108

LIQUID CHROMATOGRAPHY

Liquid-phase photoionization detector for liquid chromatography N84-22711

LIQUID CRYSTALS

Safety eye protection through use of fast acting optical switching
[AD-A138582] N84-23120

LIQUID FLOW

Multicolor printing plate joining
[NASA-CASE-LEW-13598-1] N84-22930

LIQUID FUELS

Neutron radiographic study of liquid propellant combustion N84-22669

Liquid propellant ignition studies N84-22670

LIQUID HYDROGEN
Study of systems and technology for liquid hydrogen production independent of fossil fuels
[NASA-CR-173422] N84-22768
LIQUID LASERS
Bibliography of Soviet Laser Developments, Number 63, January-February 1983
[AD-A138742] N84-22948
LIQUID PHASE EPITAXY
Ferroelectric tungsten bronze bulk crystals and epitaxial thin films for electro-optic device applications
[AD-A138693] N84-23278
LIQUID PROPELLANT ROCKET ENGINES
Investigation of combustion characteristics of a high chamber pressure rocket motor N84-22693
LIQUID-SOLID INTERFACES
Dual clearance squeeze film damper
[NASA-CASE-LEW-13508-1] N84-22562
LITERATURE
The Shock and Vibration Digest, volume 16, no. 3
[AD-A139707] N84-22976
LITHIUM
Radiation damage and defect behavior in ion-implanted, lithium counterdoped silicon solar cells
[NASA-TM-83646] N84-22890
LITHIUM CHLORIDES
Use of a polyacetylene cathode in primary lithium-thionyl chloride cells
[AD-A138791] N84-22896
LITHOLOGY
Geology and geochronology of the southeast border of the Bitterroot Dome: Implications for the structural evolution of the Mylonitic Carapace N84-23065
Structure of the Brevard Zone and Blue Ridge near Lenoir, North Carolina, with observations on oblique crenulation cleavage and a preliminary theory for irrotational structures in shear zones N84-23067
LITHOSPHERE
Application of Magsat lithospheric modeling in South America. Part 1: Processing and interpretation of magnetic and gravity anomaly data
[E84-10115] N84-23008
The structure of the Ionian lithosphere N84-23435
New maps of Lakshmi Planum and eastern Aphrodite, Venus N84-23457
LOAD DISTRIBUTION (FORCES)
Corrosion and load transfer effects on fatigue of mechanically fastened joints. Fatigue of zero load transfer specimen
[AD-A139042] N84-22985
LOAD TESTS
Study of large viscoplastic strains in cylindrical shells by method of magnetic-pulse loading N84-22798
LOADS (FORCES)
The fatigue of powder metallurgy alloys
[AD-A138714] N84-22738
Dynamic stifness of closed gas-static bearing with regulator N84-22774
Study of large viscoplastic strains in cylindrical shells by method of magnetic-pulse loading N84-22798
State space method for optimal design of shock absorbers with floating boundaries N84-22966
CASE (Computer-Aided Structural Engineering) study of 6 major general-purpose finite element programs
[AD-A139065] N84-22986
Finite element analysis of structure subjected to nonstationary load fields with contact interfaces N84-22993
Effects of transverse loading on the thickness shear resonance frequencies in crystal plates N84-22994
A discrete-element analysis for large deflection of thin plates: A combined effect of geometric and material nonlinearities N84-22995
Compressional features in the Tharsis Region of Mars: Orientations and Timing of Deformation N84-23539
LOCI
On systems with spectral cluster points and their relation to H sup p spaces
[RR-235] N84-23222
LOGIC DESIGN
Software engineering for user interfaces
[AD-A138937] N84-23155
LOGISTICS
Local bifurcation of a logistic delay map
[MC-TW-246/83] N84-23205
Increasing spares competition in AFLC (Air Force Logistics Center)
[AD-P002775] N84-23322
Policy initiatives to achieve readiness and support objectives
[AD-P002804] N84-23350
The new MIL-STDs (Military standard) 1388
[AD-P002806] N84-23352
LOGISTICS MANAGEMENT
Consolidation of DOD bidder's mailing list application
[AD-P002752] N84-23299
1982 US Army Materiel Development and Readiness Command (DARCOM) integrated logistic support (ILS) study finding on contracting for ILS
[AD-P002805] N84-23351
Central Demand Data Base (CDDB) End Item Code (EIC)
[AD-P002807] N84-23353
Improved management of support resources
[AD-P002808] N84-23354
Quality assurance - Air Force Logistics Command
[AD-P002816] N84-23361
LONG DURATION EXPOSURE FACILITY
Certification vibration tests, SD802 materials experiment
[AD-A138547] N84-22982
LONG DURATION SPACE FLIGHT
Behavioral biology of mammalian reproduction and development for a space station
[NASA-CR-173493] N84-23092
LOW ASPECT RATIO WINGS
Numerical simulation of the tip vortex off a low-aspect-ratio wing at transonic speed
[NASA-TM-85932] N84-22535
Theory of hypersonic three-dimensional flow of nonsteady gas stream with relaxation past thin wing with arbitrary aspect ratio N84-22791
LOW LEVEL TURBULENCE
Correlation between the meteorological parameters and the optical strength of atmospheric turbulence close to the ground. Part 3: Results
[BAE-BT-10771] N84-23070
LOW NOISE
Low noise tuned amplifier
[NASA-CASE-GSC-12567-1] N84-22887
LOW PRESSURE
Introduction to the Laser-HANE experiment and summary of low-pressure interaction results
[AD-A138945] N84-22952
LOW TEMPERATURE
Cognitive performance change during a 6-hour hike at low temperature in simulated rain, at controlled walking rates
[AD-A138358] N84-23100
LUMINOSITY
The luminosity function of galaxies in CO-12 N84-23424
Dynamics and evolution of cD galaxies N84-23425
LUMINOUS INTENSITY
An automated system for characterizing laser pulses
[AD-A138580] N84-22945
LUNAR ALBEDO
Recent comet impacts on the moon: The evidence from spectral reflectance studies N84-23453
LUNAR COMPOSITION
Surface compositions in the Aristarchus Region: Implications for regional stratigraphy N84-23519
LUNAR CRATERS
Recent comet impacts on the moon: The evidence from spectral reflectance studies N84-23453
Does saturation cratering exist in the solar system? N84-23467
LUNAR CRUST
Recent comet impacts on the moon: The evidence from spectral reflectance studies N84-23453
LUNAR EVOLUTION
Recent comet impacts on the moon: The evidence from spectral reflectance studies N84-23453
LUNAR FLIGHT
Cost estimation model for advanced planetary programs, fourth edition
[NASA-CR-173495] N84-22590
LUNAR GEOLOGY
The Borealis Basin of Mars N84-23472
Surface compositions in the Aristarchus Region: Implications for regional stratigraphy N84-23519
Correction and geological analysis of lunar 3.5 CM radar data N84-23531
LUNAR MARIA
Does saturation cratering exist in the solar system? N84-23467
LYRAE CONSTELLATION
A survey of halo RR Lyrae stars N84-23409

M

MACHINE ORIENTED LANGUAGES
Documentation for the machine-readable version of a supplement to the Bright Star catalogue (Hoffleit, Saladyga and Wlasuk 1983)
[NASA-TM-85573] N84-23415
Documentation for the machine-readable version of the catalogue of 20457 Star positions obtained by photography in the declination zone -48 deg to -54 deg (1950)
[NASA-TM-85572] N84-23416
Documentation for the machine-readable version of a table of Redshifts for Abell clusters (Sarazin, Rood and Struble 1982)
[NASA-TM-85571] N84-23417
Documentation for the machine-readable version of the SAO-HD-GC-DM cross index version 1983
[NASA-TM-85570] N84-23418
Documentation for the machine-readable version of the Smithsonian Astrophysical Observatory Star catalogue (SAO) version 1984
[NASA-TM-85574] N84-23419
Documentation for the machine-readable version of the general catalogue of 33342 stars for the epoch 1950 (Boss 1937)
[NASA-TM-85568] N84-23420
MAGMA
Modeling Io volcanism: Maximum volcanic temperatures, depths of melting and magma composition N84-23436
Chronology, morphology and stratigraphy of pumiceous pyroclastic-flow (ignimbrite) deposits from the eruption of Mount St. Helens on 18 May 1983 N84-23478
MAGNESIUM
Select fiber composites for space applications: A mechanistic assessment
[NASA-TM-83631] N84-22702
MAGNETIC ANOMALIES
Use of MAGSAT anomaly data for crustal structure and mineral resources in the US midcontinent
[E84-10112] N84-23005
Application of Magsat lithospheric modeling in South America. Part 1: Processing and interpretation of magnetic and gravity anomaly data
[E84-10115] N84-23008
MAGNETIC INDUCTION
Transient processes in an inductor system consisting of a flat coil and a multilayer conducting medium
[AD-A139053] N84-23232
MAGNETIC MEASUREMENT
Observations of short period magnetic pulsations during the SBARMO-79 campaign: Data summary
[REPT-90/1982] N84-23052
Quick-look tables of continuous pulsations (Pc1) and Intervals of Pulsations of Diminishing Periods (IPDP) magnetic pulsation events recorded in Finland during IMS years 1976-1979: Data summary
[REPT-92/1982] N84-23053
MAGNETIC RESONANCE
Investigations of radical-radical reactions using a far infrared Laser Magnetic Resonance (Fir-LMR) spectrometer
[MPIS-4/1983] N84-22730
MAGNETIC STORMS
Energetics of the magnetosphere, revised
[NASA-TM-86063] N84-23041
Observations of short period magnetic pulsations during the SBARMO-79 campaign: Data summary
[REPT-90/1982] N84-23052
MAGNETIC TAPES
Documentation for the machine-readable version of a supplement to the Bright Star catalogue (Hoffleit, Saladyga and Wlasuk 1983)
[NASA-TM-85573] N84-23415
Documentation for the machine-readable version of the general catalogue of 33342 stars for the epoch 1950 (Boss 1937)
[NASA-TM-85568] N84-23420
MAGNETIC VARIATIONS
Coherence study of geomagnetic fluctuations in frequency range .04 - 0.6 HZ between remote land sites
[AD-A138542] N84-23042
MAGNETIZATION
Development of high frequency low weight power magnetics for aerospace power systems
[NASA-TM-83656] N84-22892
MAGNETOHYDRODYNAMIC FLOW
Axisymmetric MHD equilibria with flow — Tokamaks
[IPP-6/230/] N84-23262
Hydrodynamic theory of convective transport across a dynamically stabilized diffuse boundary layer — plasma flow
[JUEL-1869] N84-23275
MAGNETOHYDRODYNAMIC STABILITY
A classical picture of anomalous effects in a Tokamak
[IPPJ-664] N84-23263
A rf-induced stability of mirrors with inverted pressure profiles
[DE84-007018] N84-23273
Hydrodynamic theory of convective transport across a dynamically stabilized diffuse boundary layer — plasma flow
[JUEL-1869] N84-23275
MAGNETOHYDRODYNAMIC WAVES
Dependence of hydromagnetic energy spectra on interplanetary parameters
[AD-A138745] N84-23209

MAGNETOHYDRODYNAMICS
Dependence of hydromagnetic energy spectra on interplanetary parameters
[AD-A136745] N84-23209
Moving ring reactor KARIN-I
[IPPJ-660] N84-23265
Design and fabrication of a surface conversion negative ion source and an 80 keV pre-accelerator
[DE84-006753] N84-23269
Magnetic fusion energy research and development
[DE84-007089] N84-23270
MAGNETOPAUSE
Energetics of the magnetosphere, revised
[NASA-TM-86063] N84-23041
MAGNETOSPHERE
Energetics of the magnetosphere, revised
[NASA-TM-86063] N84-23041
MAINTENANCE
Integrated testing and maintenance technologies
[AD-A136587] N84-22528
Moisture transport in composites during repair work
[AD-A136658] N84-22703
Documentation for software maintenance
[AD-A136863] N84-23152
Central Demand Data Base (CDDB) End Item Code (EIC)
[AD-P002607] N84-23353
MALEATES
Fire and heat resistant laminating resins based on maleimido substituted aromatic cyclotriphosphazenes
[NASA-CASE-ARC-11426-1] N84-22697
MAN MACHINE SYSTEMS
En route/terminal ATC (Air Traffic Control) operations concept
[AD-A136991] N84-22550
Development of a generalized human-machine interface
[AD-P002888] N84-22849
Research on cognitive collaboration between persons and computers
[AD-P002892] N84-22853
A man-machine interface concept for a state-of-art, shipboard, command/control console
[AD-P002894] N84-22854
Alternative knowledge acquisition interface structures
[AD-A139019] N84-23109
Human factors aspects of C3 systems — command, control, communication (C3)
[PP-119] N84-23115
An experimental comparison of operator responses to voice and tone system warnings
[BAE-BT-12051] N84-23117
Bibliography on direct voice input and direct voice output
[BAE-BT-12363] N84-23118
Human factors in space telepresence
[NASA-CR-173420] N84-23119
Evaluating multiple coordinated windows for programming workstations N84-23146
Software engineering for user interfaces
[AD-A136937] N84-23155
Program Manager's Support System (PMSS): An update
[AD-P002625] N84-23370
Computer developments at Institute of Automation and Electrometry described N84-23390
Research in man-machine interaction discussed N84-23393
Beyond the data base: Technology for information resource management
[AD-A136840] N84-23402
MANAGEMENT ANALYSIS
Managers handbook for software development
[NASA-TM-85604] N84-23150
West Europe report: Science and technology
[JPRS-WST-84-011] N84-23224
Thomson semiconductors bipolar IC strategy to 1986 N84-23227
Contract requirements: A key to controlling DoD acquisition costs
[AD-P002628] N84-23373
Incentives for new production discussed N84-23388
MANAGEMENT INFORMATION SYSTEMS
Mechanized contract document preparation and abstract system
[AD-P002750] N84-23297
The acquisition management information system: Friend or foe?
[AD-P002751] N84-23298
Program Manager's Support System (PMSS): An update
[AD-P002625] N84-23370
Increasing the Contractor/Subcontractor/Vendor bidding lists
[AD-P002636] N84-23381
A study of MX environmental management information system (MXEMIS) needs
[AD-A139025] N84-23404
MANAGEMENT METHODS
Material handling: A target for productivity improvement
[AD-P002829] N84-23374
USSR report: Science and technology policy
[JPRS-UST-84-005] N84-23394
Problems of prompt adoption of new technology discussed N84-23396
MANAGEMENT PLANNING
Office automation in the acquisition environment
[AD-P002747] N84-23294
The microcomputer in the acquisition environment
[AD-P002748] N84-23295
Paperless solicitation and contracting
[AD-P002749] N84-23296
Mechanized contract document preparation and abstract system
[AD-P002750] N84-23297
The acquisition management information system: Friend or foe?
[AD-P002751] N84-23298
Consolidation of DOD bidder's mailing list application
[AD-P002752] N84-23299
DECISION TECHNOLOGY: The catalyst for acquisition improvement
[AD-P002755] N84-23302
Designing the equitable risk contract
[AD-P002756] N84-23303
Assumption of risk in the R and D environment
[AD-P002757] N84-23304
Skunkworks 81 revisited: An update on acquisition strategy
[AD-P002759] N84-23306
Closing the gap between R and D and application in academe to better support government and industry
[AD-P002761] N84-23308
Training acquisition personnel through a local college
[AD-P002766] N84-23313
The make or buy decision--its nature and impact
[AD-P002779] N84-23326
Project: Acquisition strategy
[AD-P002809] N84-23355
Large firm efficiency, concentration, and profitability in defense markets
[AD-P002810] N84-23356
New initiatives in international programs
[AD-P002813] N84-23359
Rationalization, standardization and interoperability: Protecting US interests in the process
[AD-P002814] N84-23360
Quality assurance - Air Force Logistics Command
[AD-P002816] N84-23361
The avionics integrity program (AVIP)
[AD-P002817] N84-23362
Quality at the crossroads
[AD-P002818] N84-23363
Incentives for product quality need contract, cost, production and field co-operation
[AD-P002819] N84-23364
A quality improvement strategy for systems acquisition
[AD-P002820] N84-23365
Defense systems acquisition review process: A history and evaluation
[AD-P002822] N84-23367
A concept for mission-oriented planning for system acquisition at the Defense Communications Agency
[AD-P002823] N84-23368
Project management: Evolution and influence
[AD-P002824] N84-23369
Program Manager's Support System (PMSS): An update
[AD-P002825] N84-23370
Mortality and spareparts: A conceptual analysis
[AD-P002826] N84-23371
Contract requirements: A key to controlling DoD acquisition costs
[AD-P002828] N84-23373
Material handling: A target for productivity improvement
[AD-P002829] N84-23374
Strengthening small business participation in Department of Defense extramural research and development
[AD-P002832] N84-23377
Employment changes resulting from the award of contracts in labor surplus areas
[AD-P002834] N84-23379
Automating the source selection process
[AD-P002835] N84-23380
The Score technique: An analytical approach for assessing the results of manufacturing reviews
[AD-P002838] N84-23383
Publication in professional journals in science and engineering: A survey of editorial procedures and opinion
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MANAGEMENT SYSTEMS
Corporate DP planning: New approaches and new concerns — data processing (DP)
[PNR-90180] N84-23386
MANEUVERS
Optimal maneuver detection and estimation in multiobject tracking
[AD-P002899] N84-22858
MANIFOLDS (MATHEMATICS)
Cohomology of the 3-differentiable of the Poisson algebra of a symplectic manifold N84-23175
Estimates of one-dimensional oscillatory integrals N84-23179
MANIPULATORS
Adaptive control strategies for computer-controlled manipulators N84-23114
Human factors in space telepresence
[NASA-CR-173420] N84-23119
MANPOWER
Prerequisites for the establishment of a professional acquisition workforce
[AD-P002763] N84-23310
MANUAL CONTROL
Frequency encoded auditory display of the critical tracking task
[NASA-TM-85869] N84-22558
MANUFACTURING
Manufacturing cost analysis for photovoltaic concentrator tracking structures
[DE84-006318] N84-23032
Qualities of SEP ceramic-ceramic Cerasep composites N84-23225
The Score technique: An analytical approach for assessing the results of manufacturing reviews
[AD-P002838] N84-23383
MAPPING
Age and evolution of the Yukon-Tanana Terrane, southeastern Yukon Territory N84-23060
Dual aperture multispectral Schmidt objective
[NASA-CASE-GSC-12756-1] N84-23248
Reports of planetary geology program, 1983
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Volcanic forms in the Kane Patera region, Io N84-23437
New models for landform evolution on Io N84-23443
Mapping and geological analysis of Mercury radar data N84-23532
The Galilean Satellite Geological Mapping Program, 1983 N84-23541
MAPS
Geology of Dione N84-23444
MARINE ENVIRONMENTS
Scientific activity in oceanography, 1979-1982 N84-23064
MARINE PROPULSION
Industrial and marine engine derivatives: A spin-off from aviation — gas turbine engines
[PNR-90197] N84-22581
MARINER 10 SPACE PROBE
Ode to gravity: Depth/diameter for fresh craters on Mercury N84-23470
MARKET RESEARCH
Large firm efficiency, concentration, and profitability in defense markets
[AD-P002810] N84-23356
Export trade: Big business for the small entrepreneur
[AD-P002811] N84-23357
MARKOV CHAINS
Image compression: A 2-dimensional run-length coding N84-23162
A note on the overflow process from a finite Markovian queue
[MC-BW-179/83] N84-23211
MARKOV PROCESSES
A note on the overflow process from a finite Markovian queue
[MC-BW-179/83] N84-23211
MARS (PLANET)
Differential degradation of Martian impact basins N84-23468
The Borealis Basin of Mars N84-23472
Geomorphic clues to the Martian volatile inventory. 1: Flow ejecta blankets N84-23474
Distribution and properties of small volcanoes in Acidalia Planitia N84-23478
Freezing of Martian streams under climatic conditions N84-23498
Dark streaks on talus slopes, Mars N84-23499
Quantitative and experimental modelling of sapping networks N84-23500
Planetary geomorphology field studies: Washington and Alaska N84-23501

A regression model for the temporal development of soil pipes and associated gullies in the alluvial-fill valley of the Rio Puerco, central New Mexico N84-23502
Experiments examining the shapes of isolated bars in comparison with those occurring in braided rivers N84-23503
The erosion of streamlined islands, longitudinal grooves and scour marks: Implications to the origin of the Martian outflow channels N84-23504
Small-scale polygons on Mars N84-23505
Permafrost on Mars: distribution, formation, and geological role N84-23506
Glacial and periglacial landforms in Denmark: Scandinavian analogs for Martian features N84-23507
Curvilinear ground on Mars: The search for terrestrial analogs N84-23508
Weathered stony meteorites from Victoria Land, Antarctica, as possible guides to rock weathering on Mars N84-23509
Salts in the dry valleys of Antartica N84-23510
Multiprocess evolution of landforms in the Kharga Region, Egypt: Applications to Mars N84-23511
Inversion of topography in Martian highlands terrains N84-23512
The Corfu landslide: Analog to giant landslides on Mars N84-23513
Scarp development in the Valles Marineris N84-23515
Elysium Region, Mars: Characterization of tectonic features N84-23534
Ancient volcano-tectonic structures of the Olympus Mons Region, Mars N84-23535
Mars apleostratigraphy N84-23536
Valles Marineris layered deposits: Implications of origin N84-23537
Compressional features in the Tharsis Region of Mars: Geographic N84-23538
Compressional features in the Tharsis Region of Mars: Orientations and Timing of Deformation N84-23539

MARS ATMOSPHERE
Martian paleoclimate N84-23427
MM-wavelength measurements of CO in the atmosphere of Mars and SO2 in the atmosphere of Venus N84-23429
Martian dust storms witnessed by Viking Lander 1 N84-23487
Long range transport of fine grained sediments on Mars: Atmospheric dust loading, as inferred from Viking Lander imaging data N84-23488

MARS CRATERS
Martian crater size distributions and terrain age N84-23462
The Borealis Basin of Mars N84-23472
Fluvial erosion of impact craters: Earth and Mars N84-23494
Inversion of topography in Martian highlands terrains N84-23512
Rapid extraction of relative topography from Viking orbiter images. 2: Application to irregular topographic features N84-23523
Mars apleostratigraphy N84-23536

MARS ENVIRONMENT
Martian paleoclimate N84-23427
Freezing of Martian streams under climatic conditions N84-23498

MARS SURFACE
Martian crater size distributions and terrain age N84-23462
The Borealis Basin of Mars N84-23472
Volcanism in Elysium Planitia, Mars N84-23481
Wind streaks on Mars: Comparisons of production models with observations of bright streaks N84-23486
Martian dust storms witnessed by Viking Lander 1 N84-23487
Long range transport of fine grained sediments on Mars: Atmospheric dust loading, as inferred from Viking Lander imaging data N84-23488
Dust streaks on Mars: Colors and photometry N84-23489
A possible source for the Martian circumpolar dune material N84-23490
Velocities of windblown particles in saltation: Venus, Earth, and Mars N84-23491
Fluvial drainage systems: Margaritifer Sinus and Agyre (NC, NE) quadrangles, Mars N84-23497
Freezing of Martian streams under climatic conditions N84-23498
Dark streaks on talus slopes, Mars N84-23499
Quantitative and experimental modelling of sapping networks N84-23500
Planetary geomorphology field studies: Washington and Alaska N84-23501
A regression model for the temporal development of soil pipes and associated gullies in the alluvial-fill valley of the Rio Puerco, central New Mexico N84-23502
Experiments examining the shapes of isolated bars in comparison with those occurring in braided rivers N84-23503
The erosion of streamlined islands, longitudinal grooves and scour marks: Implications to the origin of the Martian outflow channels N84-23504
Small-scale polygons on Mars N84-23505
Permafrost on Mars: distribution, formation, and geological role N84-23506
Glacial and periglacial landforms in Denmark: Scandinavian analogs for Martian features N84-23507
Weathered stony meteorites from Victoria Land, Antarctica, as possible guides to rock weathering on Mars N84-23509
Salts in the dry valleys of Antartica N84-23510
Multiprocess evolution of landforms in the Kharga Region, Egypt: Applications to Mars N84-23511
Inversion of topography in Martian highlands terrains N84-23512
The Corfu landslide: Analog to giant landslides on Mars N84-23513
Planetary geomorphology field studies: Iceland and Antarctica N84-23514
Scarp development in the Valles Marineris N84-23515
Geomorphic clues to the Martian volatile inventory: Landslides N84-23516
A tectonic geomorphological classification of the walls of Valles Marineris N84-23518
A case for olivine on Mars N84-23520
Thermal infrared analysis of volcanic surfaces: Mars and Hawaii N84-23524
The case for aeolian control of meter-scale surface texture on Mars N84-23528
Is there radar evidence for liquid water on Mars? N84-23529
Hypsometric studies of Mars. N84-23530
Ancient volcano-tectonic structures of the Olympus Mons Region, Mars N84-23535
Mars apleostratigraphy N84-23536
Valles Marineris layered deposits: Implications of origin N84-23537
Compressional features in the Tharsis Region of Mars: Geographic N84-23538
Compressional features in the Tharsis Region of Mars: Orientations and Timing of Deformation N84-23539

MARS VOLCANOES
Volcanism in the Valles Marineris N84-23480
Volcanism in Elysium Planitia, Mars N84-23481
The 19 March 1982 eruption and lahar at Mount Saint Helens: Implications for Martian outflow channels? N84-23495
Ancient volcano-tectonic structures of the Olympus Mons Region, Mars N84-23535
Compressional features in the Tharsis Region of Mars: Geographic N84-23538
Compressional features in the Tharsis Region of Mars: Orientations and Timing of Deformation N84-23539

MASKS
A high speed processor for binary images [AD-A138908] N84-23125

MASS FLOW
Heat/mass flow enhancement design for a metal hydride assembly, phase 2 [DE84-007182] N84-22920
Shock waves and mass outflow in the Orion molecular cloud: Observations of far-infrared emission lines of carbon monoxide, hydroxyl and ammonia N84-23423

MASS SPECTROSCOPY
Mass spectroscopic investigations of the reactions of O2 (1 deltag) with furan, 2-methylfuran, and 2,5-dimethylfuran in the gas phase [MPIS-7/1983] N84-22731
Current trends in atomic spectroscopy [PB84-162957] N84-22732

MASS TRANSFER
A novel X-ray backlighting method for Rayleigh-Taylor instability measurements on ablatively driven targets [AD-A138644] N84-22937

MASSACHUSETTS
Stratigraphic, geochemical, and petrologic studies of the Ammonoosuc volcanics, northcentral Massachusetts and southwestern New Hampshire N84-23059

MATERIALS HANDLING
Priorities for detailed quality assessments of the National Defense Stockpile nonfuel materials [NMAB-403] N84-23011
Material handling: A target for productivity improvement [AD-P002629] N84-23374

MATHEMATICAL MODELS
A Generalized Escape System Simulation (GESS) computer program: GESS user's guide, version 2, volume 1 [AD-A138844] N84-22545
Model identification and parameter estimation of the power, lift, and drag of light aircraft from a single maneuver N84-22552
The 14th JANNAF Plume Technology Meeting, volume 1 [AD-A139654] N84-22619
Theoretical calculation of H/sub 2 S- and Q-branch spectra for propellant flames N84-22636
Rocket motor aeroacoustics N84-22642
On the oscillatory flowfield in solid rocket motors N84-22645
Modeling the self-deflagration of HMX N84-22682
Modeling effects of composition on the burn rates of nitrate ester-based energetic binders N84-22685
Vortex motion in a precombustion chamber with intersecting jets [AD-A139040] N84-22717
Hypersonic flow around flat body in case of intense radiative heat exchange N84-22795
Wave drag of elongated astroid bodies at moderate supersonic flight velocities N84-22797
Information processing and decisionmaking organizations: A mathematical description [AD-P002878] N84-22839
Asymptotic models for wave scattering from very rough surfaces N84-22883
Parametric and nonparametric Fast Kalman echo cancellation N84-22901
Turbulence modeling [NASA-TM-85889] N84-22913
CONSERVB: A numerical method to compute soil water content and temperature profiles under a bare surface [E84-10113] N84-23006
Evaporation from a bare soil evaluated from a soil water transfer model using remotely sensed surface soil moisture data [CRPE-NT-125] N84-23016
Thermodynamic model for a central receiver of a solar plant with partial shading of the heliostat field [ESA-TT-807] N84-23034
A one dimensional model for the study of upwelling [INPE-2936-RPE/445] N84-23086
Some comparisons between NVL and oracle-based MRTD approaches — vision models [BAE-BT-11240] N84-23096
Modeling of inhalation administration of vapors with capacity limited clearance [AD-A138647] N84-23098
Stability and performance deterioration due to modelling errors — plant models [RR-236] N84-23166
An exactly solvable model for ideally polarizable interfaces [AD-A138719] N84-23182
The ideally polarizable interface: A solvable model and general sum rules [AD-A138720] N84-23207
Ice-covered volcanic water flows on Ganymede N84-23432
Modeling Io volcanism: Maximum volcanic temperatures, depths of melting and magma composition N84-23436
Geologic studies of outer solar system satellites: Iapetus and Europa N84-23448
Venus banded terrain: Evaluation of tectonic models for the origin of banding N84-23458
Ring spacing of Mercurian multi-ring basins and basin ring formation N84-23464
Radar backscatter modelling N84-23525

MATHEMATICAL PROGRAMMING
A framework for the probabilistic analysis of hierarchial planning systems [MC-SW-180/83] N84-23216

MATRICES (MATHEMATICS)
Image compression: A 2-dimensional run-length coding N84-23162

MAXIMUM LIKELIHOOD ESTIMATES
Multi-sensor array time-delay estimation with small phase incoherences [AD-A138867] N84-23183
The luminosity function of galaxies in CO-12 N84-23424

MAXWELL EQUATION
Transient processes in an inductor system consisting of a flat coil and a multilayer conducting medium [AD-A139053] N84-23232

MEAN
Documentation for the machine-readable version of the Survey of the Astrographic Catalogue From 1 to 31 Degrees of Northern Declination (Fresneau 1983) [NASA-TM-85589] N84-23421

MEANDERS
Experimental investigations of rivulet meanders — flow instability [MPIS-5/1983] N84-23015

MEASURING INSTRUMENTS
Device and method for frictionally testing materials for ignitability
[NASA-CASE-MSC-20622-1] N84-22596
An optical surface tracking device which determines a solid propellent's burning rate N84-22638
In-situ measurement of burning rate N84-22639
Measurement of solid propellant burning rates employing microwave techniques N84-22640
Electronic scanning pressure measuring system and transducer package
[NASA-CASE-ARC-11361-1] N84-22934
Multi-sensor array time-delay estimation with small phase incoherences
[AD-A138667] N84-23183
Wind abrasion on Venus: A means for experimental investigations N84-23455

MECHANICAL ENGINEERING
Bibliography of technical publications and papers, October 1982 - September 1983
[AD-A138807] N84-23403

MECHANIZATION
The impact of factory automation and robotics on the contracting and acquisition processes
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MEDIA
Exact solution to problem of interaction between wedge moving at supersonic velocity and interface of two gaseous media N84-22790

MELTING
Shock consolidation of powders: Theory and experiment
[DE84-007273] N84-22741

MELTING POINTS
High pressure melting and crystallization of Nylon-11
[AD-A138858] N84-22760

MELTS (CRYSTAL GROWTH)
Bulk formation of metallic glasses and amorphous silicon from the melt
[NASA-CR-171012] N84-22752
InP materials
[AD-A138992] N84-23282

MEMORY
Information theoretic models of memory in human decisionmaking models
[AD-P002883] N84-22844

MENTAL PERFORMANCE
Cognitive performance change during a 6-hour hike at low temperature in simulated rain, at controlled walking rates
[AD-A138358] N84-23100
Ability and expertise in act generation
[AD-A137973] N84-23110
Problem analysis and definition in act generation
[AD-A137978] N84-23111

MERCURY (PLANET)
Mercury: New identification of ancient multi-ring basins and implications for geologic evolution N84-23463
Ring spacing of Mercurian multi-ring basins and basin ring formation N84-23464
Ode to gravity: Depth/diameter for fresh craters on Mercury N84-23470
Mapping and geological analysis of Mercury radar data N84-23532
Mercury: Topographic and geologic data from Earth-based radar observations N84-23533

MERGING ROUTINES
Compactness in semantics for merge and fair merge
[MC-IW-238/83] N84-23199

MESOSCALE PHENOMENA
Effects of mesoscale weather distrubances on contamination concentrations
[DE84-005753] N84-23036
A statistical evaluation and comparison of VISSR Atmospheric Sounder (VAS) data and corresponding rawinsonde measurements
[NASA-TM-82575] N84-23071

METAL AIR BATTERIES
Chemically rechargeable battery
[NASA-CASE-NPO-16024-1] N84-23020

METAL FATIGUE
Review of the effects of microstructure on fatigue in aluminum alloys
[NASA-TM-83626] N84-22735

METAL HYDRIDES
Heat/mass flow enhancement design for a metal hydride assembly, phase 2
[DE84-007182] N84-22920

METAL JOINTS
Corrosion and load transfer effects on fatigue of mechanically fastened joints. Fatigue of zero load transfer specimen
[AD-A139042] N84-22985

METAL OXIDE SEMICONDUCTORS
Technology of the radiation hardened MOS devices
[AD-A138995] N84-23283

METAL OXIDES
Absorbable-susceptor joining of ceramic surfaces
[NASA-CASE-NPO-15840-1] N84-22748

METAL PLATES
Revision of design values for 7075-T7351 and 7075-T7651 aluminum plate
[AD-A139092] N84-22740
Multicolor printing plate joining
[NASA-CASE-LEW-13596-1] N84-22930

METAL POWDER
Diamondlike flakes
[NASA-CASE-LEW-13837-2] N84-22696

METAL PROPELLANTS
An investigation of experimental techniques for obtaining particulate behavior in metallized solid propellant combustion N84-22659
Conditions for inflammation of accumulated aluminum in the propellant combustion zone N84-22660
Combustion of high-aluminum-content propellants N84-22661

METAL VAPOR LASERS
Procedure for wall temperature measurement in a metal vapor laser N84-22777
Hollow cathode cell for pulsed lasers using metal vapors and their chemical compounds N84-22778

METALLIC GLASSES
Bulk formation of metallic glasses and amorphous silicon from the melt
[NASA-CR-171012] N84-22752

METALLIC PLASMAS
Power transfer for microwave discharges
[AD-A138668] N84-23267
Physics of high temperature, dense plasmas
[AD-A138872] N84-23268

METALLURGY
Thermoelastic stresses in metal with temperature: Dependent properties in radiant heating
[BLL-M-35526-(5828.4)] N84-22733
USSR report: Science and technology policy
[JPRS-UST-84-007] N84-23391

METALS
Device and method for frictionally testing materials for ignitability
[NASA-CASE-MSC-20622-1] N84-22596
On the limiting electrode potential in cavities and its role in deciding between SCC (Stress Corrosion Cracking) and HC (Hydrogen Cracking) in metals
[AD-A138585] N84-22713
Grit blasting a distributed roughness based on a 30% probability of exceedence
[AD-A138779] N84-22809
Role of abrasion in the optical polishing of metals and glass
[DE84-005737] N84-23259

METAMORPHISM (GEOLOGY)
Stratigraphic, geochemical, and petrologic studies of the Ammonoosuc volcanics, northcentral Massachusetts and southwestern New Hampshire N84-23059

METASTABLE STATE
Modification of the near surface region metastable phases and ion induced reactions
[AD-A138842] N84-22694
Primary patterns of electronically excited molecules in the gas phase 2
[MPIS-9/1983] N84-23245

METEORITE CRATERS
Impact of Upheaval Dome, Utah N84-23465
Differential degradation of Martian impact basins N84-23468
Fluvial erosion of impact craters: Earth and Mars N84-23494

METEORITES
Weathered stony meteorites from Victoria Land, Antarctica, as possible guides to rock weathering on Mars N84-23509

METEORITIC DAMAGE
Distribution and properties of small volcances in Acidalia Planitia N84-23478

METEOROLOGICAL PARAMETERS
Correlation between the meteorological parameters and the optical strength of atmospheric turbulence close to the ground. Part 3: Results
[BAE-BT-10771] N84-23070
Influence of extratropical heteorological phenomenon on the northeast Brazilian climate: A study using finite elements
[INPE-2912-PRE/425] N84-23072

METEOROLOGICAL SERVICES
World Weather Watch: The plan and implementation program, 1984-1987
[WMO-617] N84-23078

METHYLENE
Carboranylmethylene-substituted phosphazenes and polymers thereof
[NASA-CASE-ARC-11370-1] N84-22750

METHYLHYDRAZINE
MMH-nitrate and plume deposits from NTO/MMH engines N84-22620

MEXICO
Geology, geochemistry, and geochronology of volcanic rocks between Cusuhtamoc and La Junta, central Chihahua, Mexico N84-23066
Pinacate-Gran Desierto Region, Mexico: SIR-A data analysis N84-23526

MICROANALYSIS
Characterization of single crystal Cu/sub 2S/CdS heterojunctions by hing resolution electron microscopy
[DE84-006761] N84-23267

MICROCOMPUTERS
Microcomputer numerical analysis system for gas dynamics application
[NASA-CR-171005] N84-22908
The microcomputer in the acquisition environment
[AD-P002748] N84-23295

MICROELECTRONICS
Method for sequentially processing a multi-level interconnect circuit in a vacuum chamber
[NASA-CASE-MFS-256704-1] N84-22684
Fine line electromigration. The effect of crossed thermal gradients
[AD-A138854] N84-23279

MICROMECHANICS
Micromechanics of fracture in elastomers
[AD-A138783] N84-22758

MICROSCOPY
Modes of deformation and failure of Kevlar 49 fibers and composites
[DE84-004162] N84-22706

MICROSTRIP TRANSMISSION LINES
Reactively steered adaptive array (Resaa) N84-22826

MICROSTRUCTURE
Review of the effects of microstructure on fatigue in aluminum alloys
[NASA-TM-83626] N84-22735
The fatigue of powder metallurgy alloys
[AD-A138714] N84-22736
Method of making an ion beam sputter-etched ventricular catheter for hydrocephalus shunt
[NASA-CASE-LEW-13107-2] N84-23095
Properties of simulated comet mantle N84-23452

MICROWAVE ANTENNAS
Focal region characteristics of focused microwave array antennas
[AD-A138557] N84-22867

MICROWAVE ATTENUATION
Study of the 13 GHz signal attenuation due to tropical rains
[CRPE-NT-113] N84-22879
Analysis of propagation conditions at 20 and 30 GHz in Europe
[CRPE-NT-122] N84-22880

MICROWAVE EMISSION
A microwave systems approach to measuring root zone soil moisture
[E84-10114] N84-23007

MICROWAVE EQUIPMENT
Measurement of solid propellant burning rates employing microwave techniques N84-22640

MICROWAVE IMAGERY
High angular resolution microwave sensing with large, sparse, random arrays
[AD-A138717] N84-22874

MICROWAVES
Microwave curing of composites N84-22708
Doppler radar having phase modulation of both transmitted and reflected return signals
[NASA-CASE-MSC-18675-1] N84-22820
High angular resolution microwave sensing with large, sparse, random arrays
[AD-A138717] N84-22874
Power transfer for microwave discharges
[AD-A138668] N84-23267

MIDAIR COLLISIONS
System safety study of minimum TCAS II (Traffic Alert and Collision Avoidance System)
[AD-A138674] N84-22548

MIDDLE ATMOSPHERE
Effects of mesoscale weather distrubances on contamination concentrations
[DE84-005753] N84-23036

MIE SCATTERING
Temperature, concentration, and size measurements in turbulent reactive flows N84-22633

MILITARY OPERATIONS
Jam-resistant tactical communications N84-22828
Spread spectrum data networks N84-22832

MILITARY TECHNOLOGY
Contractor 'Hungriness' and the relative profitability of DoD business
[AD-P002796] N84-23342

MILKY WAY GALAXY
Far-IR spectroscopy of the galactic center: Neutral and ionized gas in the central 10 pc of the galaxy
[NASA-CR-166510] N84-23411
MILLIMETER WAVES
Precise measurement of refractive index and absorption coefficient of near millimeter wave and far infrared materials
[AD-A138656] N84-23253
Quenchings and outbursts of extragalactic radio sources: Nine years of 3.3-mm measurements and comparisons with centimeter-wave variations
[AD-A138233] N84-23550
MINERALS
Use of MAGSAT anomaly data for crustal structure and mineral resources in the US midcontinent
[E84-10112] N84-23005
MINICOMPUTERS
The use of a small digital computer for on-line behavioral experiments
[AD-A138975] N84-23126
MINIMAX TECHNIQUE
Linear multistep methods with minimized truncation error for periodic initial value problems
[MC-NW-157/83] N84-23195
MIRRORS
Dual aperture multispectral Schmidt objective
[NASA-CASE-GSC-12756-1] N84-23248
UV and VUV degradation of very high reflectivity mirrors for use in a storage ring free electron laser
[AD-A138740] N84-23255
A rf-induced stability of mirrors with inverted pressure profiles
[DE84-007018] N84-23273
MISSION PLANNING
Titan exploration with advanced systems. A study of future mission concepts
[NASA-CR-173499] N84-22593
MODELS
A comparison of two air defense command and control models
[AD-P002876] N84-22837
MODULATORS
Navigation system and method
[NASA-CASE-GSC-12508-1] N84-22546
Incorporation of a PROM spatial light modulator into a system for automatic target recognition and tracking — Pockels Readout Optical Modulator (PROM)
[BAE-BT-12841] N84-23250
MODULUS OF ELASTICITY
Role of abrasion in the optical polishing of metals and glass
[DE84-005737] N84-23259
MOISTURE
Incorporation of remotely sensed soil moisture data into a hydrologic runoff model N84-23017
MOISTURE CONTENT
Instrumentation for sensing moisture content of material using a transient thermal pulse
[NASA-CASE-NPO-15494-2] N84-22935
CONSERVB: A numerical method to compute soil water content and temperature profiles under a bare surface
[E84-10113] N84-23006
A statistical evaluation and comparison of VISSR Atmospheric Sounder (VAS) data and corresponding rawinsonde measurements
[NASA-TM-82575] N84-23071
Evolution of the Uranus-Neptune planetesimal swarm: Consequences for the Earth N84-23445
MOISTURE METERS
Moisture transport in composites during repair work
[AD-A138658] N84-22703
Instrumentation for sensing moisture content of material using a transient thermal pulse
[NASA-CASE-NPO-15494-2] N84-22935
MOLECULAR BEAM EPITAXY
The Record of Electrical and Communication Engineering Conversazione Tohoku University, volume 52, no. 4
[ISSN-0385-7719] N84-23228
All-aluminum-alloy UHV chamber for molecular beam epitaxy, 1 N84-23229
MOLECULAR EXCITATION
Primary patterns of electronically excited molecules in the gas phase 2
[MPIS-9/1983] N84-23245
MOLECULAR INTERACTIONS
Effect of interfacial bonding on the strength of adhesion of elastomers. 3: Interlinking by molecular entanglements
[AD-A138760] N84-22757
MOLECULAR STRUCTURE
Intramolecular electron transfer at metal surfaces. 1. Relative energetics of some corresponding outer- and inner-sphere pathways involving halide and pseudohalide bridging ligands
[AD-A139021] N84-22716
MOLTEN SALT ELECTROLYTES
Resistance characterization of nickel sulfide electrodes in LiCl-containing molten salt electrolytes
[DE84-006734] N84-22896
MOMENTUM
Determination of compressor in-stall characteristics from engine surge transients
[NASA-TM-83639] N84-22566
MOMENTUM TRANSFER
Vortex motion in a precombustion chamber with intersecting jets
[AD-A139040] N84-22717
MONOPROPELLANTS
Asymptotic condensed phase analysis of deflagrating monopropellants with subsurface exothermicity N84-22656
Condensed phase temperature profiles in deflagrating HMX N84-22657
MONTE CARLO METHOD
Multiple point source model for three dimensional plume flow fields N84-22625
MORPHOLOGY
The luminosity function of galaxies in CO-12 N84-23424
Morphology of buried craters: Lava thickness estimates by simulated flooding N84-23471
Chronology, morphology and stratigraphy of pumiceous pyroclastic-flow (ignimbrite) deposits from the eruption of Mount St. Helens on 18 May 1983 N84-23476
Mercury: Topographic and geologic data from Earth-based radar observations N84-23533
MORTALITY
Mortality and spareparts: A conceptual analysis
[AD-P002826] N84-23371
MOSAICS
Galilean satellite multispectral data base production N84-23521
MOTHS
The Pennsylvania defoliation application pilot test
[E84-10111] N84-23004
MOUNTAINS
WNDCOM: Estimating surface winds in mountainous terrain
[PB84-157700] N84-23083
Geology of Maxwell Montes, Venus N84-23480
MOVING TARGET INDICATORS
On a simple adaptive tracking filter
[AD-A138955] N84-23186
MUD
Planetary geomorphology field studies: Washington and Alaska N84-23501
MULTIPHASE FLOW
Multi-dimensional, multiphase flow analysis of flamespreading in a stick propellant charge N84-22663
Multiphase flow analysis of the ballistic performance of an anomalous LOVA propellant mix N84-22679
MULTIPLE ACCESS
Multiple access adaptive antennas N84-22823
MULTIPLEXING
The development and fabrication of an implantable, multiplexed, semiconductor multielectrode array
[AD-A138788] N84-22895
MULTISPECTRAL BAND SCANNERS
Spectroradiometric calibration of the Thematic Mapper and multispectral scanner system
[E84-10098] N84-23000
Sensor radiance for a midlatitude atmospheric model N84-23001
In-flight absolute radiometric calibration of the Thematic Mapper — White Sands, New Mexico N84-23002
Dual aperture multispectral Schmidt objective
[NASA-CASE-GSC-12756-1] N84-23248
MULTISPECTRAL PHOTOGRAPHY
LANDSAT 4 investigations of Thematic Mapper and multispectral scanner applications — Death Valley, California; Silver Bell Copper Mine, Arizona, and Dulles Airport near Washington, D.C.
[E84-10100] N84-23003
Galilean satellite multispectral data base production N84-23521
MX MISSILE
A study of MX environmental management information system (MXEMIS) needs
[AD-A139025] N84-23404

N

N-TYPE SEMICONDUCTORS
Near millimeter wave action in n-GaAs
[AD-A138602] N84-23252
Low-cost GaAs solar cell development
[AD-A138938] N84-23280
NASA PROGRAMS
NASA Thesaurus supplement. Part 1: Hierarchical listing
[NASA-SP-7051(SUPPL-1)] N84-23398
NASTRAN
NASTEX: Interactive display of NASTRAN-generated plots
[AD-A138831] N84-22983
NATURAL LANGUAGE (COMPUTERS)
A unified approach to modeling and combining of evidence through random set theory
[AD-P002860] N84-22841
NATURAL SATELLITES
Reports of planetary geology program, 1983
[NASA-TM-86246] N84-23431
Geologic studies of outer solar system satellites: Iapetus and Europa N84-23448
NAVIER-STOKES EQUATION
La Recherche Aerospatiale, Bimonthly bulletin, number 1983-4, 215/July-August
[ESA-TT-823] N84-22589
Theoretical investigation of three-dimensional shock wave-turbulent boundary layer interactions, part 2
[AD-A138722] N84-22916
Solutions of the Navier-Stokes equations for stationary flow in a spherical gap
[PREPRINT-611] N84-22925
NEBULAE
Physics and chemistry in the primitive solar nebula
[MPE-PREPRINT-21] N84-23547
NEGATIVE IONS
Formation of negative ions by charge transfer: He(-) to Cl(-)
[DE84-005718] N84-23243
Design and fabrication of a surface conversion negative ion source and an 80 keV pre-accelerator
[DE84-006753] N84-23269
NETHERLANDS
Forecasting the windstorm of 12 May 1983 (Acension Day) — the Netherlands
[KNMI-TR-43] N84-23079
NETWORK ANALYSIS
Empirical analysis of a token ring network
[AD-A138905] N84-23184
NETWORK SYNTHESIS
Local network wideband interconnection alternatives
[AD-A138604] N84-22868
NEUTRAL GASES
Far-IR spectroscopy of the galactic center: Neutral and ionized gas in the central 10 pc of the galaxy
[NASA-CR-166510] N84-23411
NEUTRON RADIOGRAPHY
Neutron radiographic study of liquid propellant combustion N84-22669
NEUTRON SPECTRA
Kerma factors for use in 37-group neutron spectrum calculations
[AD-A139033] N84-23240
NEUTRONS
Analysis of a fully discrete scheme for the neutron transport in cylindrical geometry
[CTH-MATH-1984-1] N84-23246
NEW HAMPSHIRE
Stratigraphic, geochemical, and petrologic studies of the Ammonoosuc volcanics, northcentral Massachusetts and southwestern New Hampshire N84-23059
NEW MEXICO
A regression model for the temporal development of soil pipes and associated gullies in the alluvial-fill valley of the Rio Puerco, central New Mexico N84-23502
NICKEL
Method of making a light weight battery plaque
[NASA-CASE-LEW-13349-1] N84-22734
NICKEL ALLOYS
The future for titanium and superalloys — in aircraft engines
[PNR-90175] N84-22742
NICKEL CADMIUM BATTERIES
A 37.5-kW point design comparison of the nickel-cadmium battery, bipolar nickel-hydrogen battery, and regenerative hydrogen-oxygen fuel cell energy storage subsystems for low Earth orbit
[NASA-TM-83651] N84-23022
NICKEL HYDROGEN BATTERIES
Separator development and testing of nickel-hydrogen cells
[NASA-TM-83653] N84-22712

Advanced nickel-hydrogen cell configuration study
[NASA-CR-173417] N84-22589
A 37.5-kW point design comparison of the nickel-cadmium battery, bipolar nickel-hydrogen battery, and regenerative hydrogen-oxygen fuel cell energy storage subsystems for low Earth orbit
[NASA-TM-83651] N84-23022
Design of a 1-kWh bipolar nickel hydrogen battery
[NASA-TM-83647] N84-23024
Advanced designs for IPV nickel-hydrogen cells
[NASA-TM-83643] N84-23025
Teardown analysis of a ten cell bipolar nickel-hydrogen battery
[NASA-TM-83618] N84-23026

NITRAMINE PROPELLANTS
Nitramine propellant ignition under rapid gas loading conditions N84-22677
Multiphase flow analysis of the ballistic performance of an anomalous LOVA propellant mix N84-22679

NITRATES
MMH-nitrate and plume deposits from NTO/MMH engines N84-22620
Modeling effects of composition on the burn rates of nitrate ester-based energetic binders N84-22685

NITRIC ACID
Kinetics and products of the reaction OH + HNO3 N84-23051

NITROAMINES
CARS studies of nitramine LOVA propellant combustion N84-22683

NITROGEN
The electron density and temperature in the photoionized background gas (N2) surrounding a laser produced plasma
[AD-A138651] N84-23266

NITROGEN OXIDES
Experimental investigation of the low NO/sub x vortex airblast annular combustor
[NASA-TM-83615] N84-22567

NOCTURNAL VARIATIONS
Untapped midwestern wind energy resource: Nocturnal low-level wind maxima
[DE84-006424] N84-23077

NOISE MEASUREMENT
Nearly optimal detection of signals in non-Gaussian noise
[AD-A138657] N84-22872

NOISE POLLUTION
Aircraft noise legislation: An overkill
[PNR-90167] N84-23037

NOISE REDUCTION
State-space structures for the realization of low roundoff noise digital filters N84-22900
Fan noise reduction achieved by removing tip flow irregularities behind the rotor - forward arc test configurations
[NASA-TM-83616] N84-23235

NONDESTRUCTIVE TESTS
A review study of nondestructive test techniques for residual stresses in aircraft transparencies
[AD-A138030] N84-22555
Non-destructive evaluation of composite materials using ultrasound
[NASA-CR-173416] N84-22969
Ultrasonic methods to study shadow boundaries of diffracting cracks. Ultrasonic caustics in NDE (Non-Destructive Evaluation)
[AD-A138639] N84-22970

NONEQUILIBRIUM FLOW
Three-dimensional nonequilibrium viscous shock-layer flow over the Space Shuttle orbiter N84-22530
Three-dimensional nonequilibrium viscous shock-layer flows over complex reentry vehicles N84-22543

NONFLAMMABLE MATERIALS
Fire and heat resistant laminating resins based on maleimido substituted aromatic cyclotriphosphazenes
[NASA-CASE-ARC-11428-1] N84-22697

NONLINEAR EQUATIONS
Thin sets in nonlinear potential theory N84-23178

NONLINEAR SYSTEMS
Hybrid perturbation/Bubnov-Galerkin technique for nonlinear thermal analysis
[NASA-TP-2145] N84-22907
Nonlinear/transient rotor dynamics analysis N84-22977
On nonlinear systems and algebraic geometry
[RR-240] N84-23196
Real-time implementation of nonlinear optical processing functions
[AD-A138643] N84-23256

NONLINEARITY
Investigation of non-linear estimation of natural resonances in target identification
[AD-A139027] N84-22878
A discrete-element analysis for large deflection of thin plates: A combined effect of geometric and material nonlinearities N84-22995

NONPARAMETRIC STATISTICS
Nearly optimal detection of signals in non-Gaussian noise
[AD-A138657] N84-22872

NORMAL DENSITY FUNCTIONS
Ultrasonic transducer with Gaussian radial pressure distribution
[NASA-CASE-LAR-12967-1] N84-22932
An interpolation type inequality for a discrete weighted norm
[CTH-MATH-1983-30] N84-23213

NORTH ATLANTIC TREATY ORGANIZATION (NATO)
Rationalization, standardization and interoperability: Protecting US interests in the process
[AD-P002814] N84-23360

NORTH CAROLINA
Structure of the Brevard Zone and Blue Ridge near Lenoir, North Carolina, with observations on oblique crenulation cleavage and a preliminary theory for irrotational structures in shear zones N84-23067

NORTHERN HEMISPHERE
Documentation for the machine-readable version of the Survey of the Astrographic Catalogue From 1 to 31 Degrees of Northern Declination (Fresnesu 1983)
[NASA-TM-85569] N84-23421

NOZZLE FLOW
Three-dimensional, two-phase supersonic nozzle flows
[AD-A138649] N84-22538

NOZZLES
Mach number and density effects in the mixing of supersonic jets N84-22628

NUCLEAR FUSION
External excitation of ion cyclotron drift waves in a two-ion species plasma
[IPPJ-665] N84-23264
Moving ring reactor KARIN-I
[IPPJ-660] N84-23265
Magnetic fusion energy research and development
[DE84-007069] N84-23270

NUCLEAR PHYSICS
Energy loss of 24.8-MeV electrons by interacting with thick layers of C, Al, Cu, and Pb
[ETL-836] N84-23277

NUCLEAR REACTORS
Nuclear reactor: On schedule and under cost
[AD-P002790] N84-23337

NUMERICAL ANALYSIS
A unified approach to modeling and combining of evidence through random set theory
[AD-P002680] N84-22841

NUMERICAL CONTROL
Direct digital control of the electric arc furnace
[RR-233] N84-22811
Automating the source selection process
[AD-P002835] N84-23380

NYLON (TRADEMARK)
Preliminary results of the effects of sewing, packing and parachute deployment on material strength
[DE84-006464] N84-22541
High pressure melting and crystallization of Nylon-11
[AD-A138858] N84-22760

O

OBLATE SPHEROIDS
Wave drag of elongated astroid bodies at moderate supersonic flight velocities N84-22797

OCEAN BOTTOM
Surface wave propagation over sinusoidally varying topography: Theory and observation
[IOS-159-PT-1] N84-22922
Surface wave propagation over sinusoidally varying topography: Theory and observation
[IOS-159-PT-2] N84-22923

OCEAN CURRENTS
Topex: Observing the oceans from Space
[NASA-CR-173490] N84-23085
A one dimensional model for the study of upwelling
[INPE-2936-RPE/445] N84-23086

OCEAN DATA ACQUISITIONS SYSTEMS
Airborne lidar for oceanography and hydrology (FLOH)
[ESA-TT-799] N84-22955
Comparisons of sea-surface temperature obtained from ship and satellite data
[AD-A138257] N84-23087
Integrated Global Ocean Services System (IGOSS): Guide to the IGOSS data processing and services system
[WMO-623] N84-23089

OCEAN SURFACE
Topex: Observing the oceans from Space
[NASA-CR-173490] N84-23085
Comparisons of sea-surface temperature obtained from ship and satellite data
[AD-A138257] N84-23087

OCEAN TEMPERATURE
Airborne lidar for oceanography and hydrology (FLOH)
[ESA-TT-799] N84-22955
Comparisons of sea-surface temperature obtained from ship and satellite data
[AD-A138257] N84-23087

OCEANOGRAPHIC PARAMETERS
Integrated Global Ocean Services System (IGOSS): Guide to the IGOSS data processing and services system
[WMO-623] N84-23089

OCEANOGRAPHY
Scientific activity in oceanography, 1979-1982 N84-23084
Topex: Observing the oceans from Space
[NASA-CR-173490] N84-23085

OLIVINE
A case for olivine on Mars N84-23520

ONBOARD EQUIPMENT
Integrated testing and maintenance technologies
[AD-A138587] N84-22528

OPERATING COSTS
Proven design + new technology = reliability + economy --- aircraft engines
[PNR-90199] N84-22973

OPERATIONS RESEARCH
Statistics and operations research in Europe--1983
[AD-A138953] N84-23215
Bibliography of technical publications and papers, October 1982 - September 1983
[AD-A138907] N84-23403

OPERATOR PERFORMANCE
An experimental comparison of operator responses to voice and tone system warnings
[BAE-BT-12051] N84-23117

OPERATORS
Annals of the Fourier Institute, volume 33, no. 4
[ISSN-0373-0956] N84-23172

OPERATORS (MATHEMATICS)
The Fourier Plancherel transform of the analytic Lie group. 1: Weyl algebras and differential operators N84-23176
Littlewood Paley's g function associated with a singular differential operator (0, infinity) N84-23180
Exponential calculus of microdifferential operators of infinite order, part 1 N84-23181
Formulas for the L-2 minimal solutions of the Delta Delta bar equation in the unit ball of C sup N
[CTH-MATH-1983-16-PREPRINT] N84-23189
Linear Volterra convolution equations: Semigroups small solutions and convergence of projection operators
[MC-TW-248/83] N84-23223

OPERATORS (PERSONNEL)
Human decisionmaking in dynamic environments with increasing information processing demands
[AD-P002884] N84-22845

OPHTHALMOLOGY
Yellow ophthalmic filters in the visual acquisition of aircraft
[AD-A138536] N84-23097

OPTICAL DATA PROCESSING
Feasibility studies of optical processing of image bandwidth compression schemes
[AD-A138736] N84-23254
Real-time implementation of nonlinear optical processing functions
[AD-A138843] N84-23256

OPTICAL EQUIPMENT
Optimization of thermal systems with sensitive optics, electronics, and structures
[NASA-CR-3745] N84-22608

OPTICAL MEASURING INSTRUMENTS
Fast Electrical and Optical Diagnostic Principles and Techniques: A NATO Advanced Study Institute
[AD-A138598] N84-22936
Correlation between the meteorological parameters and the optical strength of atmospheric turbulence close to the ground. Part 3: Results
[BAE-BT-10771] N84-23070

OPTICAL PROPERTIES
Measuring roughness of ultrasmooth surfaces by reflectometric method N84-22807
Review of free electron laser theory and experiments
[DE84-007232] N84-22954

OPTICAL RADAR
Airborne lidar for oceanography and hydrology (FLOH)
[ESA-TT-799] N84-22955

OPTICAL TRACKING
Incorporation of a PROM spatial light modulator into a system for automatic target recognition and tracking --- Pockels Readout Optical Modulator (PROM)
[BAE-BT-12841] N84-23250

OPTIMAL CONTROL
Time optimal digital control of multi-unit paper web dynamics N84-22991
Parameterization and approximation methods in feedback theory with applications in high gain, fast sampling and cheap optimal control
[RR-241] N84-23167
OPTIMIZATION
Optimization of thermal systems with sensitive optics, electronics, and structures
[NASA-CR-3745] N84-22608
Atmospheric correction study/atmospheric model optimization
[INPE-2999-RPE/448] N84-23040
Material handling: A target for productivity improvement
[AD-P002829] N84-23374
ORBIT TRANSFER VEHICLES
Optimal maneuvers of orbital transfer vehicles N84-22606
Tanker orbit transfer vehicle and method
[NASA-CASE-MSC-20543-1] N84-22610
ORBITAL SERVICING
Tanker orbit transfer vehicle and method
[NASA-CASE-MSC-20543-1] N84-22610
Constant force friction damper
[NASA-CASE-MSC-20505-1] N84-22611
ORBITAL SPACE STATIONS
Performance assessment of planetary missions as launched from an orbiting space station
[NASA-CR-173498] N84-22594
ORBITS
Cometary nucleus and active regions N84-23450
OREGON
Sedimentary response to eocene tectonic rotation in western Oregon N84-23063
ORGANIC CHEMISTRY
Chemical approach for controlling nadimide cure temperature and rate
[NASA-CASE-LEW-13770-3] N84-22698
Chemical approach for controlling nadimide cure temperature and rate
[NASA-CASE-LEW-13770-4] N84-22699
Chemical approach for controlling nadimide cure temperature and rate
[NASA-CASE-LEW-13770-5] N84-22700
Chemical approach for controlling nadimide cure temperature and rate
[NASA-CASE-LEW-13770-6] N84-22701
ORGANIC COMPOUNDS
Investigation of organic oxidizers for high performance low flame temperature gas generator applications N84-22676
Thermoset-thermoplastic aromatic polyamide containing N-propargyl groups
[NASA-CASE-LAR-12723-2] N84-22746
ORGANIZATIONS
Information processing and decisionmaking organizations: A mathematical description
[AD-P002878] N84-22839
Project management: Evolution and influence
[AD-P002824] N84-23389
USSR report: Science and technology policy
[JPRS-UST-84-007] N84-23391
ORGANOMETALLIC COMPOUNDS
Carboranylmethylene-substituted phosphazenes and polymers thereof
[NASA-CASE-ARC-11370-1] N84-22750
Safety eye protection through use of fast acting optical switching
[AD-A138582] N84-23120
ORION NEBULA
Shock waves and mass outflow in the Orion molecular cloud: Observations of far-infrared emission lines of carbon monoxide, hydroxyl and ammonia N84-23423
ORNSTEIN-UHLENBECK PROCESS
Geometric bounds on the Ornstein-Uhlenbeck velocity process
[CTH-MATH-1983-17] N84-23212
ORTHOGONAL FUNCTIONS
On orthogonal polynomials on a half line and the associated kernel polynomials
[MC-BW-182/83] N84-23192
OSCILLATING FLOW
On the oscillatory flowfield in solid rocket motors N84-22645
Effect of oscillations upon velocity distributions in simulated solid propellant flow environments N84-22646
OXIDATION
Solid carbon oxidation and radiation in exhaust plumes N84-22623
OXIDATION-REDUCTION REACTIONS
Electron-transfer kinetics of redox centers anchored to metal surfaces: Weak- versus strong-overlap reaction pathways
[AD-A139043] N84-22718
Surface-enhanced Raman spectroscopy of electrochemically characterized interfaces. Relations between Raman scattering intensity and surface coverage for simple anionic adsorbates
[AD-A139054] N84-22721
Utility of surface reaction entropies for examining reactant-solvent interactions at electrochemical interfaces. Ferricinium-ferrocene attached to platinum electrodes
[AD-A139055] N84-22722
Redox thermodynamics of surface-bound reactants. Illustrative behavior of Cobalt(3)/(2) macrobicyclic cage complexes
[AD-A139056] N84-22723
OXIDIZERS
Investigation of organic oxidizers for high performance low flame temperature gas generator applications N84-22676
OXYGEN
Effect of O2 on double-base propellant ignition N84-22673
Separator development and testing of nickel-hydrogen cells
[NASA-TM-83653] N84-22712
Mass spectroscopic investigations of the reactions of O2 (1 deltag) with furan, 2-methylfuran, and 2,5-dimethylfuran in the gas phase
[MPIS-7/1983] N84-22731
Electronically excited products in the reactions of O(3PJ) atoms with halogenated ethenes
[MPIS-8/1983] N84-23244
Primary patterns of electronically excited molecules in the gas phase 2
[MPIS-9/1983] N84-23245
Far-IR spectroscopy of the galactic center: Neutral and ionized gas in the central 10 pc of the galaxy
[NASA-CR-166510] N84-23411

P

P-TYPE SEMICONDUCTORS
Low-cost GaAs solar cell development
[AD-A138938] N84-23280
PACIFIC OCEAN
Comparisons of sea-surface temperature obtained from ship and satellite data
[AD-A138257] N84-23087
PACKING
Preliminary results of the effects of sewing, packing and parachute deployment on material strength
[DE84-006464] N84-22541
PAINTS
Corrosion control through a better understanding of the metallic substrate/organic coating/interface
[AD-A139086] N84-22739
PALEONTOLOGY
Sedimentology and invertebrate paleontology of Triassic and Jurassic Lacustrine deposits, Culpeper Basin, northern Virginia N84-23064
PARACHUTES
Preliminary results of the effects of sewing, packing and parachute deployment on material strength
[DE84-006464] N84-22541
PARALLEL PROCESSING (COMPUTERS)
The design of information structures: Basic allocation strategies for organizations
[AD-P002909] N84-22861
Comparison of processor arrays with pipeline processors for image processing
[NLR-MP-83011-U] N84-23165
PARAMETER IDENTIFICATION
Intermodulation between v.h.f./f.m. broadcast transmitters and the protection of adjacent-band aeronautical services
[BBC-RD-1984/2] N84-22819
Adaptive control strategies for computer-controlled manipulators N84-23114
PARAMETERIZATION
The use of reciprocal polar co-ordinates in passive tracking
[AD-P002906] N84-22860
Parametric and nonparametric Fast Kalman echo cancellation N84-22901
Parameterization and approximation methods in feedback theory with applications in high gain, fast sampling and cheap optimal control
[RR-241] N84-23167
PARTIAL DIFFERENTIAL EQUATIONS
Active control of distributed structures N84-22618
A middle latitude ionospheric model
[CRPE-NT-114] N84-23049
PARTICLE ACCELERATION
Anomalous laser induced bunch lengthening on the ACO storage ring free electron laser
[AD-A138814] N84-22949
PARTICLE ACCELERATORS
Experience with development of sealed linear waveguide electron accelerators N84-22780
Formation of negative ions by charge transfer: He(-) to Cl(-)
[DE84-005718] N84-23243
RFQ development at LBL
[DE84-006762] N84-23271
Energy loss of 24.8-MeV electrons by interacting with thick layers of C, Al, Cu, and Pb
[ETL-836] N84-23277
PARTICLE BEAMS
Analysis of spacecraft charging, particle beams and geophysical data bases
[AD-A138632] N84-22618
Activities report of the Institute for Extraterrestrial Physics N84-23407
PARTICLE DENSITY (CONCENTRATION)
Effects of mesoscale weather distrubances on contamination concentrations
[DE84-005753] N84-23036
PARTICLE DIFFUSION
Analysis of a fully discrete scheme for the neutron transport in cylindrical geometry
[CTH-MATH-1984-1] N84-23246
PARTICLE INTERACTIONS
Modification of the near surface region metastable phases and ion induced reactions
[AD-A138842] N84-22694
PARTICLE SIZE DISTRIBUTION
An investigation of experimental techniques for obtaining particulate behavior in metallized solid propellant combustion N84-22659
Inversion of experimental optical data
[AD-A138979] N84-23257
PARTICLES
Temperature, concentration, and size measurements in turbulent reactive flows N84-22833
An investigation of experimental techniques for obtaining particulate behavior in metallized solid propellant combustion N84-22659
PATENT POLICY
USSR report: Science and technology policy
[JPRS-UST-84-004] N84-23387
Incentives for new production discussed N84-23388
PATTERN RECOGNITION
Machine vision: Three generations of commercial systems
[AD-A139037] N84-23123
PAYLOADS
Space probe/satellite ejection apparatus for spacecraft
[NASA-CASE-MFS-15429-1] N84-22609
PELLETS
Absolutely uniform illumination of laser fusion pellets
[AD-A138944] N84-22951
PENETRATION
Measurement of melt line penetration and heat flux during arc spot welding
[DE84-002013] N84-22962
Weld penetration variations
[DE84-007915] N84-22963
PENNSYLVANIA
The Pennsylvania defoliation application pilot test
[E84-10111] N84-23004
PERFLUORO COMPOUNDS
Process for preparing perfluorotriazine elastomers and precursors thereof
[NASA-CASE-ARC-11402-1] N84-22744
PERFORMANCE PREDICTION
Comparison between measured turbine stage performance and the predicted performance using quasi-3D flow and boundary layer analyses
[NASA-TM-83640] N84-22564
PERFORMANCE TESTS
Performance evaluation of a Magnavox GPS (Global Positioning System) Z-set
[AD-A138599] N84-22547
Civil turbofan propulsion system integration studies using powered testing techniques at ARA, Bedford
[ARA-MEMO-246] N84-22581
Preliminary investigation of a two-zone swirl flow combustor
[NASA-TM-83637] N84-22585
Post-test data report for the space shuttle full-scale AFRSI sequence of environments test (OS-305-1 to -5) in the NASA/Ames Research Center 11x11-foot wind tunnel
[NASA-CR-167684] N84-22603
Investigation of combustion characteristics of a high chamber pressure rocket motor N84-22693

Apparatus for certification of angular-displacement transducers N84-22806
Certification vibration tests, SD802 materials experiment [AD-A138547] N84-22982
Wind energy test field Pellworm: Tests of the plant Bruemmer BW 120S [GKSS-83-E-42] N84-23035
Examining functional acceptance testing with structural coverage metrics N84-23142

PERIHELIONS
Comet nucleus sample return mission [NASA-CR-173501] N84-22592

PERIODIC VARIATIONS
A generalized behavioral model for rotating short period comets with spectral orbital elements and axial orientation N84-23451

PERIODICALS
Publication in professional journals in science and engineering: A survey of editorial procedures and opinion [AD-A138913] N84-23385

PERMAFROST
Permafrost on Mars: distribution, formation, and geological role N84-23506

PERMEABILITY
Analysis of production data from the Krafla geothermal field, Iceland [DE84-006881] N84-23014

PERSONNEL
Individual differences in military decisionmaking: The classification performance of active sonar operators [AD-P002685] N84-22846

PERSONNEL DEVELOPMENT
The leader of the Army acquisition workforce [AD-P002762] N84-23309
Prerequisites for the establishment of a professional acquisition workforce [AD-P002763] N84-23310
Training requirements for changing times [AD-P002764] N84-23311
Training acquisition personnel through a local college [AD-P002766] N84-23313
Government - contractor interaction [AD-P002768] N84-23315

PERSONNEL MANAGEMENT
Personnel technology: Performance appraisal, a process approach [AD-A138359] N84-23112
Projecting manpower to attain quality N84-23148
Managers handbook for software development [NASA-TM-85604] N84-23150
Assessing contracting workforce requirements in the matrixed organization [AD-P002760] N84-23307
A dynamic personnel assignment model in the R and D environment [AD-P002765] N84-23312
Improving the effectiveness of award fee contracts for program management support services [AD-P002827] N84-23372
Employment changes resulting from the award of contracts in labor surplus areas [AD-P002834] N84-23379
Research in man-machine interaction discussed N84-23393

PERTURBATION
Hybrid perturbation/Bubnov-Galerkin technique for nonlinear thermal analysis [NASA-TP-2145] N84-22907

PERTURBATION THEORY
Stochastic dynamical systems with a cyclic structure [MC-TW-247/83] N84-23214

PETROGRAPHY
East Butte: A volcanic dome of the Eastern Snake River Plain, Idaho N84-23475

PETROLEUM PRODUCTS
Tactical buying decisions for strategic petroleum reserve spot procurements: The tunnel theory [AD-P002812] N84-23358

PETROLOGY
Stratigraphic, geochemical, and petrologic studies of the Ammonoosuc volcanics, northcentral Massachusetts and southwestern New Hampshire N84-23059
A case for olivine on Mars N84-23520

PHASE DETECTORS
Three phase power factor controller [NASA-CASE-MFS-25535-2] N84-22885

PHASE LOCKED SYSTEMS
RF properties of superconducting A-15 compounds [AD-A139067] N84-23285

PHASE MODULATION
Doppler radar having phase modulation of both transmitted and reflected return signals [NASA-CASE-MSC-18675-1] N84-22820

PHASE TRANSFORMATIONS
Effect of non-constant solid phase thermal properties on temperature sensitivity of solid propellant N84-22654
Asymptotic condensed phase analysis of deflagrating monopropellants with subsurface exothermicity N84-22656
A summary of the mechanisms of delayed detonation N84-22658
Kinetics of the Beta + Delta phase transformation of HMX N84-22681
Modeling the self-deflagration of HMX N84-22682
Modification of the near surface region metastable phases and ion induced reactions [AD-A138642] N84-22694
Resistance characterization of nickel sulfide electrodes in LiCl-containing molten salt electrolytes [DE84-006734] N84-22898

PHOSPHAZENE
Carboranylmethylene-substituted phosphazenes and polymers thereof [NASA-CASE-ARC-11370-1] N84-22750

PHOSPHINES
Organometallic chemistry of weakly solvated transition metal cations [DE84-006987] N84-22726
The reaction NH2 + PH3 yields NH3 + PH2: Absolute rate constant measurement and implication for NH3 and PH3 photochemistry in the atmosphere of Jupiter [NASA-TM-85063] N84-23430

PHOSPHORUS
Photoelectrochemical cells including chalcogenophosphate photoelectrodes [NASA-CASE-LAR-12958-1] N84-23019

PHOTOCHEMICAL REACTIONS
Photochemical modeling of the Earth's stratosphere N84-23055
The reaction NH2 + PH3 yields NH3 + PH2: Absolute rate constant measurement and implication for NH3 and PH3 photochemistry in the atmosphere of Jupiter [NASA-TM-85063] N84-23430

PHOTOELASTICITY
An evaluation of algorithms for extracting stress intensity factors from photoelastic data for 3 dimensional problems N84-22974

PHOTOELECTRIC MATERIALS
Photoelectrochemical cells including chalcogenophosphate photoelectrodes [NASA-CASE-LAR-12958-1] N84-23019

PHOTOELECTRICITY
Photoelectrochemical cells including chalcogenophosphate photoelectrodes [NASA-CASE-LAR-12958-1] N84-23019

PHOTOELECTROCHEMISTRY
X-ray photoelectron and Auger electron spectroscopic study of the CdTe surface resulting from various surface pretreatments: Correlations of photoelectrochemical and capacitance-potential behavior with surface chemical composition [AD-A138601] N84-22714

PHOTOELECTRON SPECTROSCOPY
X-ray photoelectron and Auger electron spectroscopic study of the CdTe surface resulting from various surface pretreatments: Correlations of photoelectrochemical and capacitance-potential behavior with surface chemical composition [AD-A138601] N84-22714

PHOTOELECTRONS
User's manual of a program to compute the distribution of photoelectrons — atmospheric ionization [CRPE-NT-110] N84-23054

PHOTOGEOLOGY
East Butte: A volcanic dome of the Eastern Snake River Plain, Idaho N84-23475
Thermal infrared analysis of volcanic surfaces: Mars and Hawaii N84-23524

PHOTOGRAMMETRY
Rapid extraction of relative topography from Viking orbiter images. 2: Application to irregular topographic features N84-23523

PHOTOIONIZATION
Liquid-phase photoionization detector for liquid chromatography N84-22711
Spectroscopic measurements of the Laser-HANE plasma [AD-A138685] N84-22947
The electron density and temperature in the photoionized background gas (N2) surrounding a laser produced plasma [AD-A138651] N84-23286

PHOTOLUMINESCENCE
InP materials [AD-A138992] N84-23282

PHOTOLYSIS
A shock tube study of chlorine azide decomposition N84-22728

PHOTOMETERS
Comparison of Hapke's photometric theory with Voyager observations of Europa, Enceladus, Rhea and Mimas N84-23439
Voyager feature-fixed photometry of Iapetus N84-23440
Theoretical aspects of photoclinometric terrain profiling on the Galilean satellites N84-23441
Topography on Ganymede derived from photoclinometry N84-23442
High-resolution color images of Io N84-23446
Short time-scale surface changes on Io N84-23447

PHOTOMETRY
Dynamics and evolution of cD galaxies N84-23425
Dust streaks on Mars: Colors and photometry N84-23489

PHOTOMICROGRAPHY
Grit blasting a distributed roughness based on a 30% probability of exceedence [AD-A136779] N84-22809

PHOTOSENSITIVITY
Photoelectrochemical cells including chalcogenophosphate photoelectrodes [NASA-CASE-LAR-12958-1] N84-23019

PHOTOVOLTAIC CONVERSION
Study of systems and technology for liquid hydrogen production independent of fossil fuels [NASA-CR-173422] N84-22766
Photoelectrochemical cells including chalcogenophosphate photoelectrodes [NASA-CASE-LAR-12958-1] N84-23019

PIEZOELECTRIC CRYSTALS
Discrete charge diagnostics on Pre-DIRECT COURSE [AD-A139073] N84-22919

PILE FOUNDATIONS
Fixity of members embedded in concrete [AD-A138862] N84-22810

PILOT ERROR
System safety study of minimum TCAS II (Traffic Alert and Collision Avoidance System) [AD-A138674] N84-22548

PILOTS (PERSONNEL)
Quantification of subjective ratings through conjoint measurement analysis [AD-A138810] N84-22554

PIONEER VENUS SPACECRAFT
Ongoing data reduction, theoretical studies and supporting research in magnetospheric physics [NASA-CR-173419] N84-23039
Characterization of surficial geologic units on Venus from Pioneer Venus radar data: A progress report N84-23454

PIPELINING (COMPUTERS)
Comparison of processor arrays with pipeline processors for image processing [NLR-MP-83011-U] N84-23165

PIPES (TUBES)
Method of making an ion beam sputter-etched ventricular catheter for hydrocephalus shunt [NASA-CASE-LEW-13107-2] N84-23095

PITCH (INCLINATION)
Data acquisition and aerodynamic coefficient estimation at high angles of attack N84-22542
A new satellite instrument for yaw and pitch measurements [AD-A138729] N84-22599

PLANAR STRUCTURES
Scattering of an electromagnetic plane wave from a perfectly electrically conducting half-plane in the proximity of planar media discontinuities [AD-A138968] N84-22876

PLANE WAVES
Scattering of an electromagnetic plane wave from a perfectly electrically conducting half-plane in the proximity of planar media discontinuities [AD-A138968] N84-22876

PLANETARY CRATERS
The planet crossing asteroid survey: Progress in the analysis of populations and terrestrial-planet cratering rates N84-23449
Mercury: New identification of ancient multi-ring basins and implications for geologic evolution N84-23463
Ring spacing of Mercurian multi-ring basins and basin ring formation N84-23464
Morphology of buried craters: Lava thickness estimates by simulated flooding N84-23471
Fluvial erosion of impact craters: Earth and Mars N84-23494
Relationships and tectonics of the Jg-7 quadrangle of Ganymede N84-23542

PLANETARY EVOLUTION
New models for landform evolution on Io N84-23443
Evolution of the Uranus-Neptune planetesimal swarm: Consequences for the Earth N84-23445
Mercury: New identification of ancient multi-ring basins and implications for geologic evolution N84-23463

Does saturation cratering exist in the solar system? N84-23467
Multiprocess evolution of landforms in the Kharga Region, Egypt: Applications to Mars N84-23511

PLANETARY GEOLOGY
Topography on Ganymede derived from photoclinometry N84-23442
Effusion rate, length, and area relationships for some lava flows on Hawaii and Mount Etna with planetary implications N84-23482
Experiments on water/melt explosions, nature of products, and models of dispersal N84-23483
Calderas in the solar system N84-23485

PLANETARY MANTLES
New maps of Lakshmi Planum and eastern Aphrodite, Venus N84-23457
Venus banded terrain: Evaluation of tectonic models for the origin of banding N84-23458
Venus: The nature of the surface from Venera panoramas N84-23459

PLANETARY SURFACES
Morphology of buried craters: Lava thickness estimates by simulated flooding N84-23471
Cratering history of the Saturnian satellites N84-23473
Desert pavement study at Amboy, California N84-23492
Planetary geomorphology field studies: Washington and Alaska N84-23501
Mapping and geological analysis of Mercury radar data N84-23532
Mercury: Topographic and geologic data from Earth-based radar observations N84-23533
Interpretation of planetary stress systems: Determination of tectonic over-printing in Northwest Wyoming N84-23540

PLANNING
A knowledge based interactive procedure for planning and decision support under uncertainty and parameter imprecision
[AD-P002890] N84-22851
Air Force Systems Command research planning guide (research objectives)
[AD-A138851] N84-23384

PLANT ROOTS
A microwave systems approach to measuring root zone soil moisture
[E84-10114] N84-23007

PLASMA ACCELERATORS
Design and fabrication of a surface conversion negative ion source and an 80 keV pre-accelerator
[DE84-006753] N84-23269

PLASMA BUBBLES
Introduction to the Laser-HANE experiment and summary of low-pressure interaction results
[AD-A138945] N84-22952

PLASMA CYLINDERS
Thermal characteristics of plasma reactors with cylindrical and conical multijet mixing chambers N84-22788

PLASMA DECAY
Power transfer for microwave discharges
[AD-A138868] N84-23267

PLASMA DIAGNOSTICS
Power transfer for microwave discharges
[AD-A138868] N84-23267
Physics of high temperature, dense plasmas
[AD-A138872] N84-23268
Activities report of the Institut fuer Plasmaforschung N84-23276

PLASMA DIFFUSION
Hydrodynamic theory of convective transport across a dynamically stabilized diffuse boundary layer — plasma flow
[JUEL-1869] N84-23275

PLASMA DRIFT
F-layer ionization patches in the polar cap
[AD-A138633] N84-23044
Long wavelength limit of interchange instabilities
[AD-A138943] N84-23047

PLASMA EQUILIBRIUM
Axisymmetric MHD equilibria with flow — Tokamaks
[IPP-6/230/] N84-23262

PLASMA FOCUS
Activities report of the Institut fuer Plasmaforschung N84-23276

PLASMA HEATING
External excitation of ion cyclotron drift waves in a two-ion species plasma
[IPPJ-665] N84-23264
Design and fabrication of a surface conversion negative ion source and an 80 keV pre-accelerator
[DE84-006753] N84-23269
Options for an ignited tokamak
[DE84-007927] N84-23272

PLASMA INTERACTIONS
Thermal characteristics of plasma reactors with cylindrical and conical multijet mixing chambers N84-22788
The beam-density effect on energy loss of a relativistic charged particle beam
[AD-A139051] N84-23241

PLASMA JETS
Liquid propellant ignition studies N84-22670
Thermal characteristics of plasma reactors with cylindrical and conical multijet mixing chambers N84-22788

PLASMA PHYSICS
Formation of negative ions by charge transfer: He(-) to Cl(-)
[DE84-005718] N84-23243

PLASMA PINCH
Activities report of the Institut fuer Plasmaforschung N84-23276

PLASMAS (PHYSICS)
Thermal characteristics of plasma reactors with cylindrical and conical multijet mixing chambers N84-22788
Spectroscopic measurements of the Laser-HANE plasma
[AD-A138685] N84-22947
An exactly solvable model for ideally polarizable interfaces
[AD-A138719] N84-23182
The ideally polarizable interface: A solvable model and general sum rules
[AD-A138720] N84-23207

PLASTIC DEFORMATION
Stressed-strained state of flanged shells under heavy thermal load beyond elastic limit N84-22600

PLATES (STRUCTURAL MEMBERS)
Effects of transverse loading on the thickness shear resonance frequencies in crystal plates N84-22994

PLATES (TECTONICS)
Cenozoic tectonics of the Caribbean: Structural and stratigraphic studies in Jamaica and Hispaniola N84-23062
Sedimentary response to eocene tectonic rotation in western Oregon N84-23063
New maps of Lakshmi Planum and eastern Aphrodite, Venus N84-23457

PLOTTERS
NASTEK: Interactive display of NASTRAN-generated plots
[AD-A138831] N84-22983

PLUNGERS
Constant force friction damper
[NASA-CASE-MSC-20505-1] N84-22611

POISSON DENSITY FUNCTIONS
Poisson integrals of absolutely continuous and other measures
[CTH-MATH-1983-10] N84-23210

POLAR CAPS
F-layer ionization patches in the polar cap
[AD-A138633] N84-23044

POLAR COORDINATES
The use of reciprocal polar co-ordinates in passive tracking
[AD-P002906] N84-22860

POLAR REGIONS
A possible source for the Martian circumpolar dune material N84-23490

POLARIZATION (CHARGE SEPARATION)
The ideally polarizable interface: A solvable model and general sum rules
[AD-A138720] N84-23207

POLARIZATION (WAVES)
Study of the 13 GHz signal attenuation due to tropical rains
[CRPE-NT-113] N84-22879

POLARIZED ELECTROMAGNETIC RADIATION
Calculation procedures for variational, Born and exact solutions for electromagnetic scattering from two randomly separated dielectric Rayleigh cylinders
[AD-A138543] N84-22865

POLICIES
Intermodulation between v.h.f./f.m. broadcast transmitters and the protection of adjacent-band aeronautical services
[BBC-RD-1984/2] N84-22819
Project: Acquisition strategy
[AD-P002809] N84-23355
Use of economic mechanisms in managing scientific and technical progress N84-23389

POLLUTION MONITORING
Emissions variability and traversing on production RB211 engines
[PNR-90176] N84-22573

POLYAMIDE RESINS
Thermoset-thermoplastic aromatic polyamide containing N-propargyl groups
[NASA-CASE-LAR-12723-2] N84-22746
High temperature adhesives for structural applications: A review — aircraft engines
[PNR-90171] N84-22767

POLYCARBONATES
Development of an impact resistant test method for polycarbonate
[AD-A139082] N84-22988

POLYCRYSTALS
High temperature failure mechanisms in ceramic polycrystals
[DE84-006641] N84-22764
Plasma-initiated laser deposition of polycrystalline and monocrystalline silicon films
[DE84-005527] N84-22953
InP materials
[AD-A138992] N84-23282

POLYGONS
Connectivity of circulant digraphs
[MC-BW-186/83] N84-23220
Small-scale polygons on Mars N84-23505

POLYIMIDE RESINS
Chemical approach for controlling nadimide cure temperature and rate
[NASA-CASE-LEW-13770-3] N84-22698
Chemical approach for controlling nadimide cure temperature and rate
[NASA-CASE-LEW-13770-4] N84-22699
Chemical approach for controlling nadimide cure temperature and rate
[NASA-CASE-LEW-13770-5] N84-22700
Chemical approach for controlling nadimide cure temperature and rate
[NASA-CASE-LEW-13770-6] N84-22701
Hydrolytic degradation of kapton film
[AD-A139016] N84-22762

POLYMER CHEMISTRY
Status of ammonium nitrate in propellants and explosives N84-22655
Use of a polyacetylene cathode in primary lithium-thionyl chloride cells
[AD-A138791] N84-22896

POLYMERIC FILMS
Chemical properties and film casting of radiation grafted ion-containing polymers
[AD-A138551] N84-22754

POLYMERIZATION
Supercritical solvent coal extraction
[NASA-CASE-NPO-15210-1] N84-22709
Thermoset-thermoplastic aromatic polyamide containing N-propargyl groups
[NASA-CASE-LAR-12723-2] N84-22746
Polyphenylene ethers with imide linking groups
[NASA-CASE-LAR-12980-1] N84-22749
Carboranylmethylene-substituted phosphazenes and polymers thereof
[NASA-CASE-ARC-11370-1] N84-22750
Chemical properties and film casting of radiation grafted ion-containing polymers
[AD-A138551] N84-22754

POLYMERS
Phosphorus-containing imide resins
[NASA-CASE-ARC-11368-3] N84-22745
Carboranylmethylene-substituted phosphazenes and polymers thereof
[NASA-CASE-ARC-11370-1] N84-22750
Deformation studies of polymers by Fourier transform infrared spectroscopy N84-22751
Effect of pressure on the mechanical properties of polymers, part 1
[DE84-006311] N84-22765

POLYNOMIALS
A computer program for the evaluation of cubic splines
[BAE-BT-11729] N84-23131
Factoring multivariate integral polynominals
[MC-IW-229/83] N84-23190
Factoring multivariate integral polynomials, part 2
[MC-IW-230/83-PT-2] N84-23191
On orthogonal polynomials on a half line and the associated kernel polynomials
[MC-BW-182/83] N84-23192
Polynomial factorization by root approximation
[MC-IW-242/83] N84-23201

POLYPHENYL ETHER
Polyphenylene ethers with imide linking groups
[NASA-CASE-LAR-12980-1] N84-22749

POLYPHENYLS
Polyphenylene ethers with imide linking groups
[NASA-CASE-LAR-12980-1] N84-22749

POLYSTYRENE
Television system for monitoring target position in laser thermonuclear fusion experiments N84-22781

POLYURETHANE RESINS
Evaluation of 'Sorbothane' cushioning material
[AD-A139079] N84-22763
PONDEROMOTIVE FORCES
A rf-induced stability of mirrors with inverted pressure profiles
[DE84-007018] N84-23273
POPULATION INVERSION
Near millimeter wave action in n-GaAs
[AD-A139602] N84-23252
POPULATION THEORY
Bifurcation of map resonance 1 : 4
[MC-TW-245/83] N84-23204
POPULATIONS
The planet crossing asteroid survey: Progress in the analysis of populations and terrestrial-planet cratering rates N84-23449
POROSITY
Characterization of zirconium alloy oxidation films by alternating current impedance
[DE84-006225] N84-22766
POROUS MATERIALS
Effect of pressure on the static and dynamic acoustic properties of porous rubber
[AD-A138744] N84-22758
Acoustic-to-Seismic coupling over porous ground surfaces
[AD-A139753] N84-23046
PORTABLE EQUIPMENT
Two-dimensional scanner apparatus — flaw detector in small flat plates
[NASA-CASE-MFS-25687-1] N84-22928
POSITION (LOCATION)
Formal and group Picard localization N84-23174
POSITIONING
Performance evaluation of a Magnavox GPS (Global Positioning System) Z-set
[AD-A139569] N84-22547
POSITIVE FEEDBACK
The queue G/G/1c: Finite moments of the cycle variables and uniform rates of convergence
[CTH-MATH-1983-24] N84-23218
POTENTIAL THEORY
Annals of the Fourier Institute, volume 33, no. 4
[ISSN-0373-0956] N84-23172
Thin sets in nonlinear potential theory N84-23176
POWDER METALLURGY
Review of the effects of microstructure on fatigue in aluminum alloys
[NASA-TM-83628] N84-22735
The fatigue of powder metallurgy alloys
[AD-A139714] N84-22738
Shock consolidation of powders: Theory and experiment
[DE84-007273] N84-22741
POWER
Development of high frequency low weight power magnetics for aerospace power systems
[NASA-TM-83656] N84-22892
POWER EFFICIENCY
Development of high frequency low weight power magnetics for aerospace power systems
[NASA-TM-83656] N84-22892
POWER FACTOR CONTROLLERS
Motor power control circuit for ac induction motors
[NASA-CASE-MFS-25323-1] N84-22886
Advances in solid state switchgear technology for large space power systems
[NASA-TM-83652] N84-22891
POWER SUPPLIES
Development of high frequency low weight power magnetics for aerospace power systems
[NASA-TM-83656] N84-22892
Method and apparatus for precision control of radiometer
[NASA-CASE-NPO-15398-1] N84-22931
POWER SUPPLY CIRCUITS
Development of high frequency low weight power magnetics for aerospace power systems
[NASA-TM-83656] N84-22892
POWERED LIFT AIRCRAFT
V/STOL concepts in the United States: Past, present, and future
[NASA-TM-85938] N84-22532
V/STOL maneuverability and control
[NASA-TM-85939] N84-22584
PRECIPITATION (METEOROLOGY)
Influence of extratropical heteorological phenomenon on the northeast Brazilian climate: A study using finite elements
[INPE-2912-PRE/425] N84-23072
PRECISION
Toward a theory of library and information science N84-23405
PREDICTION ANALYSIS TECHNIQUES
A Generalized Escape System Simulation (GESS) computer program: GESS user's guide, version 2, volume 1
[AD-A139844] N84-22545
The development of advanced specimen testing and analysis techniques applied to fracture mechanics lifing of gas turbine components
[PNR-90179] N84-22575
The 14th JANNAF Plume Technology Meeting, volume 1
[AD-A139854] N84-22619
Application of the CONTAM 3 computer model to the prediction of heating, forces, and contamination on a communications satellite N84-22621
Multiple point source model for three dimensional plume flow fields N84-22625
Mach number and density effects in the mixing of supersonic jets N84-22628
Theoretical predictions of excitation cross sections for collisions of HF, HCl, CO, H2O, and CO2 with O(P-3) N84-22630
Strength of bolted joints in laminated composites N84-22992
Prediction of atmospheric flow and dispersion over sloping terrain N84-23056
An approach to software cost estimation
[NASA-TM-85907] N84-23136
Implementation of an optimal multicommodity network flow algorithm based on gradient projection and a path flow formulation
[AD-A139935] N84-23154
Acoustic environmental accuracy requirements for response determination
[NASA-CR-171003] N84-23234
On 'Before' and 'After' cost comparisons
[AD-P002799] N84-23345
PREDICTIONS
Theoretical predictions for the phase stability of dense binary mixtures N84-23428
PREMIXED FLAMES
Mechanism of soot formation in premixed C2H2/O2 flames N84-22727
PREPROCESSING
A potentially powerful method of simple automatic recognition exhibiting scale and orientation independance — image processing
[BAE-BT-11068] N84-23102
PRESSURE DISTRIBUTION
Ultrasonic transducer with Gaussian radial pressure distribution
[NASA-CASE-LAR-12987-1] N84-22932
PRESSURE EFFECTS
Real time pressure signal system for a rotary engine
[NASA-CASE-LEW-13622-1] N84-22559
PRESSURE MEASUREMENT
Electronic scanning pressure measuring system and transducer package
[NASA-CASE-ARC-11361-1] N84-22934
PRESSURE OSCILLATIONS
Analysis of acoustic chamber pressure oscillations in shuttle high-pressure SRB's N84-22651
PRESSURE REDUCTION
Method of making an ion beam sputter-etched ventricular catheter for hydrocephalus shunt
[NASA-CASE-LEW-13107-2] N84-23095
PRESSURE SENSORS
Ceramic-to-metal bonding for pressure transducers
[NASA-CR-173500] N84-22753
Electronic scanning pressure measuring system and transducer package
[NASA-CASE-ARC-11361-1] N84-22934
PRIMATES
Some considerations of forms and distributions of receptive field units in early visual processing
[BAE-BT-11177] N84-23103
PRINTED CIRCUITS
An assessment of the reliability of edge connectors — circuit boards
[ERA-82-22] N84-22868
PRINTING
Multicolor printing plate joining
[NASA-CASE-LEW-13506-1] N84-22930
PROBABILITY DENSITY FUNCTIONS
Software for explicitly probabilistic mathematics
[AD-P002881] N84-22842
PROBABILITY DISTRIBUTION FUNCTIONS
Software for explicitly probabilistic mathematics
[AD-P002881] N84-22842
Study of the 13 GHz signal attenuation due to tropical rains
[CRPE-NT-113] N84-22879
Fast evaluation of the numerical error rate in the presence of intersymbolic interference
[CRPE-NT-127] N84-23158
On obtaining physical meaning from the parameters in the Weibull distribution
[AD-A139574] N84-23206
PROBABILITY THEORY
A unified approach to modeling and combining of evidence through random set theory
[AD-P002880] N84-22841
The effects of a spatial information format on decision making performance in a C3 (Command, Control, and Communications) probabilistic information integration task
[AD-P002887] N84-22848
Distributed estimation systems
[AD-P002898] N84-22857
On obtaining physical meaning from the parameters in the Weibull distribution
[AD-A139574] N84-23206
PROBLEM SOLVING
Fluid-dynamically coupled solid propellant combustion instability - cold flow simulation N84-22644
Generation of vehicle wobbling by the unsteady flow field in a spinning solid propellant rocket motor N84-22648
Direct measurement of high frequency solid propellant response functions N84-22649
Thermoelastic stresses in metal with temperature: Dependent properties in radiant heating
[BLL-M-35526-(5828.4)] N84-22733
Hypersonic flow around flat body in case of intense radiative heat exchange N84-22795
Transonic flow around protruding corner with free streamline N84-22796
Plane motion of solid body on rough surface of annular bearing rotating about its axis perpendicular to plane of motion N84-22801
System for torque control of unbalanced rotor during passage through resonance N84-22802
Solving statics problems of thick-walled cylindrical shells with loose contact between layers N84-22805
Research on cognitive collaboration between persons and computers
[AD-P002892] N84-22853
Dynamic, hierarchical decision problems
[AD-P002912] N84-22963
Linear dynamics of cables and chains N84-22978
Ability and expertise in act generation
[AD-A137973] N84-23110
Problem analysis and definition in act generation
[AD-A137978] N84-23111
Transformations of software design and code may lead to reduced errors N84-23145
Prerequisites for scientific-technical progress enumerated N84-23395
PROCESS CONTROL (INDUSTRY)
Analysis of the transfer function model of tray-type binary distillation columns with liquid hydraulic delay
[RR-234] N84-22816
PROCUREMENT MANAGEMENT
Consolidation of DOD bidder's mailing list application
[AD-P002752] N84-23299
An intelligent manual for price analysis
[AD-P002798] N84-23344
1982 US Army Materiel Development and Readiness Command (DARCOM) integrated logistic support (ILS) study finding on contracting for ILS
[AD-P002805] N84-23351
Improving the effectiveness of award fee contracts for program management support services
[AD-P002827] N84-23372
PROCUREMENT POLICY
Selection of multiple sources in weapon systems acquisition
[AD-P002837] N84-23382
PRODUCT DEVELOPMENT
The accelerating pace of advancing aero engine technology
[PNR-90191] N84-22577
Characterization of humidity sensors and physical properties of h20
[AD-A139024] N84-22938
Airborne lidar for oceanography and hydrology (FLOH)
[ESA-TT-799] N84-22955
Managers handbook for software development
[NASA-TM-85604] N84-23150
West Europe report: Science and technology
[JPRS-WST-84-011] N84-23224
Thomson semiconductors bipolar IC strategy to 1986 N84-23227
PRODUCTION COSTS
Engine affordability — aircraft engines
[PNR-90178] N84-22574
PRODUCTION ENGINEERING
A review of advanced manufacturing technology — gas turbine components
[PNR-90194] N84-22815

Method for sequentially processing a multi-level interconnect circuit in a vacuum chamber [NASA-CASE-MFS-256704-1] N84-22884
Cost risk trade-offs in timing the production decision [AD-P002753] N84-23300
The make or buy decision--its nature and impact [AD-P002779] N84-23326
An automated airframe production cost model [AD-P002787] N84-23334
Quality at the crossroads [AD-P002818] N84-23363
Material handling: A target for productivity improvement [AD-P002829] N84-23374
The impact of factory automation and robotics on the contracting and acquisition processes [AD-P002830] N84-23375
A survey of contractor productivity measurement practices [AD-P002831] N84-23376
Research in man-machine interaction discussed N84-23393

PRODUCTION MANAGEMENT
DECISION TECHNOLOGY: The catalyst for acquisition improvement [AD-P002755] N84-23302
Two-step industrial preparedness planning: Balancing funds and production capability [AD-P002802] N84-23348
Readiness planning in a peacetime environment [AD-P002803] N84-23349
Policy initiatives to achieve readiness and support objectives [AD-P002804] N84-23350
Use of economic mechanisms in managing scientific and technical progress N84-23389
Research in man-machine interaction discussed N84-23393

PRODUCTION PLANNING
Economic production rate study [AD-P002793] N84-23340
Two-step industrial preparedness planning: Balancing funds and production capability [AD-P002802] N84-23348

PRODUCTIVITY
Analysis of production data from the Krafla geothermal field, Iceland [DE84-006861] N84-23014
Export trade: Big business for the small entrepreneur [AD-P002811] N84-23357
Material handling: A target for productivity improvement [AD-P002829] N84-23374
A survey of contractor productivity measurement practices [AD-P002831] N84-23376

PROGRAM VERIFICATION (COMPUTERS)
Proceedings of the Eighth Annual Software Engineering Workshop [NASA-TM-85445] N84-23137
An error-specific approach to testing N84-23143
Testing and error analysis of a real-time controller N84-23144
Cleanroom certification model N84-23147
Projecting manpower to attain quality N84-23148
An approach to software baseline generation N84-23149

PROJECT MANAGEMENT
Definition of technology development missions for early space stations. Large space structures, phase 2, midterm review [NASA-CR-171004] N84-22607
Space Station Systems Technology Study. Volume 3: Technology and Advancement Program Plan [NASA-CR-171016] N84-22613
World Weather Watch: The plan and implementation program, 1984-1987 [WMO-617] N84-23078
Monitoring software development through dynamic variables N84-23139
Managers handbook for software development [NASA-TM-85604] N84-23150
Managing for success in defense systems acquisition [AD-P002789] N84-23336
Project management: Evolution and influence [AD-P002824] N84-23369
Improving the effectiveness of award fee contracts for program management support services [AD-P002827] N84-23372
USSR report: Science and technology policy [JPRS-UST-84-004] N84-23387
Assessment of the NASA Flight Assurance Review Program [NASA-CR-173418] N84-23401

PROJECT PLANNING
World Weather Watch: The plan and implementation program, 1984-1987 [WMO-617] N84-23078
Managers handbook for software development [NASA-TM-85604] N84-23150
Corporate DP planning: New approaches and new concerns — data processing (DP) [PNR-90180] N84-23386
Incentives for new production discussed N84-23388
Technical and economic indicators for industrial technological institutes N84-23392

PROJECTILE CRATERING
The planet crossing asteroid survey: Progress in the analysis of populations and terrestrial-planet cratering rates N84-23449
Recent comet impacts on the moon: The evidence from spectral reflectance studies N84-23453
Martian crater size distributions and terrain age N84-23482

PROJECTIVE GEOMETRY
On nonlinear systems and algebraic geometry [RR-240] N84-23196

PROPARGYL GROUPS
Thermoset-thermoplastic aromatic polyamide containing N-propargyl groups [NASA-CASE-LAR-12723-2] N84-22746

PROPELLANT CHEMISTRY
Modeling effects of composition on the burn rates of nitrate ester-based energetic binders N84-22685

PROPELLANT COMBUSTION
The 20th JANNAF Combustion Meeting, volume 1 [AD-A138033] N84-22632
Theoretical calculation of H/sub 2 S- and Q-branch spectra for propellant flames N84-22636
Neutron radiographic study of liquid propellant combustion N84-22669
Liquid propellant ignition studies N84-22670
Effect of O2 on double-base propellant ignition N84-22673

PROPELLANT EXPLOSIONS
A summary of the mechanisms of delayed detonation N84-22658

PROPELLANT GRAINS
Acoustic and photoelectric burnout detection of T-burner grains N84-22650

PROPELLANT SENSITIVITY
Ignitibility studies of LOVA propellants — low vulnerability gun propellants N84-22678

PROPELLANT TESTS
Combustion of high-aluminum-content propellants N84-22681
Slotted stick propellant study N84-22684
Closed vessel combustion studies of stick propellant N84-22685
Flash X-ray with image enhancement applied to combustion events N84-22686
Multiphase flow analysis of the ballistic performance of an anomalous LOVA propellant mix N84-22679

PROPELLANTS
A review of in situ propellant production techniques for solar system exploration [NASA-CR-173494] N84-22595
Status of ammonium nitrate in propellants and explosives N84-22655

PROPULSION SYSTEM CONFIGURATIONS
V/STOL concepts in the United States: Past, present, and future [NASA-TM-85938] N84-22532
Investigation of combustion characteristics of a high chamber pressure rocket motor N84-22693
Aerodynamic effect of combustor inlet-air pressure on fuel jet atomization [NASA-TM-83611] N84-22910

PROPULSION SYSTEM PERFORMANCE
Model identification and parameter estimation of the power, lift, and drag of light aircraft from a single maneuver N84-22552
Preliminary investigation of a two-zone swirl flow combustor [NASA-TM-83637] N84-22585
Coupling between velocity oscillations and solid propellant combustion N84-22643
Effect of oscillations upon velocity distributions in simulated solid propellant flow environments N84-22648
Investigation of combustion characteristics of a high chamber pressure rocket motor N84-22693
Aerodynamic effect of combustor inlet-air pressure on fuel jet atomization [NASA-TM-83611] N84-22910

PROPULSIVE EFFICIENCY
Generation of vehicle wobbling by the unsteady flow field in a spinning solid propellant rocket motor N84-22648
Direct measurement of high frequency solid propellant response functions N84-22649

PROTECTIVE CLOTHING
Heat resistant protective hand covering [NASA-CASE-MSC-20261-2] N84-23113

PROTECTIVE COATINGS
Corrosion control through a better understanding of the metallic substrate/organic coating/interface [AD-A139066] N84-22739
Method and apparatus for coating substrates using a laser [NASA-CASE-LEW-13526-1] N84-22944
Pulsed D2-F2 chain-laser damage to coated window and mirror components [AD-A138911] N84-22950
Novolac as stain protective film during optical glass fabrication [DE84-005736] N84-23260

PROTOPLANETS
Evolution of the Uranus-Neptune planetesimal swarm: Consequences for the Earth N84-23445

PROTOTYPES
Characteristics of a prototype experiment N84-23140

PUBLIC LAW
Contractor fraud: Government response [AD-P002833] N84-23378

PULSE COMMUNICATION
Evaluation of the comprehension of non-continuous, sped-up vocoded speech: A strategy for coping with fading HF (High Frequency) channels [AD-A138650] N84-22871

PULSED LASERS
Controller for the electro-optical shutter of a dual pulse laser N84-22776
Hollow cathode cell for pulsed lasers using metal vapors and their chemical compounds N84-22778
Miniaturized pulsed CO2 laser with sealed electron source N84-22782
Pulsed D2-F2 chain-laser damage to coated window and mirror components [AD-A138911] N84-22950

PULSES
Energetics of vortex ring formation [AD-A138795] N84-22539
Instrumentation for sensing moisture content of material using a transient thermal pulse [NASA-CASE-NPO-15494-2] N84-22935

PUMPING
Determination of compressor in-stall characteristics from engine surge transients [NASA-TM-83639] N84-22566

PURIFICATION
Deep level impurities in germanium and silicon: Low temperature passivation or removal techniques [DE84-006772] N84-23286

PYROLYSIS
Convective heating of energetic materials N84-22672
A shock tube study of chlorine azide decomposition N84-22726

PYROMETERS
Three-color pyrometer for burning particle temperature measurement N84-22635

PYROTECHNICS
Ignitibility studies of LOVA propellants — low vulnerability gun propellants N84-22678

Q

QUADRATIC EQUATIONS
On the Z sub 2 extensions of an imaginary quadratic field N84-23173

QUADRUPOLES
RFQ development at LBL [DE84-006782] N84-23271

QUALIFICATIONS
Environmental qualification tests, signal conditioning unit, SD802 materials experiment [AD-A139910] N84-22897

QUALITY CONTROL
Priorities for detailed quality assessments of the National Defense Stockpile nonfuel materials [NMAB-403] N84-23011
Users guide for ERB 7 MAT (including the first year quality control) [NASA-CR-170514] N84-23134
Quality assurance - Air Force Logistics Command [AD-P002816] N84-23361
The avionics integrity program (AVIP) [AD-P002817] N84-23362
Quality at the crossroads [AD-P002818] N84-23363
A quality improvement strategy for systems acquisition [AD-P002820] N84-23365

Engine product performance agreements and the future
[AD-P002821] N84-23366
Assessment of the NASA Flight Assurance Review Program
[NASA-CR-173418] N84-23401
QUANTITATIVE ANALYSIS
On the generation and use of quantitative criteria for assessing software maintenance quality N84-23128
QUANTUM ELECTRODYNAMICS
Current trends in atomic spectroscopy
[PB84-162957] N84-22732
QUASARS
Activities report of the Institute of Astronomy N84-23422
Study of variability in extragalactic radio sources at 22 GHz and 44 GHz
[INPE-2913-TDL/149] N84-23549
QUATERNIONS
Symmetric systems with semisimple structure algebra: The quaternionic case
[NASA-CR-173421] N84-23193
QUEUEING THEORY
A comparison of two air defense command and control models
[AD-P002876] N84-22837
An N to the 1.618th power lower bound on the time to simulate one queue or two pushdown stores by one tape
[MC-IW-245/83] N84-23161
A note on the overflow process from a finite Markovian queue
[MC-BW-179/83] N84-23211
Some analytical aspects of the peakedness concept
[MC-BW-183/83] N84-23217
The queue G/G/1c: Finite moments of the cycle variables and uniform rates of convergence
[CTH-MATH-1983-24] N84-23218
Process algebra semantics for queues
[MC-IW-241/83] N84-23219

R

RADAR ANTENNAS
High angular resolution microwave sensing with large, sparse, random arrays
[AD-A136717] N84-22874
RADAR CROSS SECTIONS
Is there radar evidence for liquid water on Mars? N84-23529
RADAR GEOLOGY
Characterization of surficial geologic units on Venus from Pioneer Venus radar data: A progress report N84-23454
Radar backscatter modelling N84-23525
Pinacate-Gran Desierto Region, Mexico: SIR-A data analysis N84-23526
Radar-visible wind streaks in the Altiplano of Bolivia N84-23527
The case for aeolian control of meter-scale surface texture on Mars N84-23528
Hypsometric studies of Mars. N84-23530
Mapping and geological analysis of Mercury radar data N84-23532
Mercury: Topographic and geologic data from Earth-based radar observations N84-23533
Valles Marineris layered deposits: Implications of origin N84-23537
RADAR IMAGERY
Venus: Global distribution of Pioneer-Venus radar roughness and reflectivity and global correlation of altimetry, roughness and reflectivity observations N84-23461
Pinacate-Gran Desierto Region, Mexico: SIR-A data analysis N84-23526
Correction and geological analysis of lunar 3.8 CM radar data N84-23531
RADAR MAPS
Venus: Global distribution of Pioneer-Venus radar roughness and reflectivity and global correlation of altimetry, roughness and reflectivity observations N84-23461
RADAR PHOTOGRAPHY
Mapping and geological analysis of Mercury radar data N84-23532
RADAR RECEIVERS
High angular resolution microwave sensing with large, sparse, random arrays
[AD-A136717] N84-22874
RADAR SCATTERING
Investigation of non-linear estimation of natural resonances in target identification
[AD-A139027] N84-22878
Radar backscatter modelling N84-23525
The case for aeolian control of meter-scale surface texture on Mars N84-23528
RADAR TARGETS
Target super-resolution compensation for coherent airborne radar utilizing spread spectrum waveforms
[AD-A136545] N84-22866
RADIAL DISTRIBUTION
Ultrasonic transducer with Gaussian radial pressure distribution
[NASA-CASE-LAR-12967-1] N84-22932
RADIAL FLOW
Variable stator radial turbine
[NASA-CR-174663] N84-22566
RADIANCE
In-flight absolute radiometric calibration of the Thematic Mapper — White Sands, New Mexico N84-23002
Atmospheric correction study/atmospheric model optimization
[INPE-2969-RPE/446] N84-23040
Application of VISSR Atmospheric Sounder (VAS) data
[NASA-TM-82574] N84-23073
RADIANT COOLING
Radiative cooler — spacecraft radiators
[NASA-CASE-NPO-15465-1] N84-22903
RADIANT HEATING
Thermoelastic stresses in metal with temperature: Dependent properties in radiant heating
[BLL-M-35526-(5828.4)] N84-22733
RADIATION COUNTERS
Modulated voltage metastable ionization detector
[NASA-CASE-ARC-11503-1] N84-23093
RADIATION DAMAGE
Radiation damage and defect behavior in ion-implanted, lithium counterdoped silicon solar cells
[NASA-TM-83646] N84-22890
RADIATION DETECTORS
Method and apparatus for precision control of radiometer
[NASA-CASE-NPO-15398-1] N84-22931
Deep level impurities in germanium and silicon: Low temperature passivation or removal techniques
[DE84-006772] N84-23286
RADIATION EFFECTS
Latchup window tests
[AD-A136680] N84-22894
RADIATION HARDENING
Technology of the radiation hardened MOS devices
[AD-A138995] N84-23283
RADIATION SHIELDING
Energy loss of 24.8-MeV electrons by interacting with thick layers of C, Al, Cu, and Pb
[ETL-836] N84-23277
RADIATION TOLERANCE
Technology of the radiation hardened MOS devices
[AD-A138995] N84-23283
RADIATION TRANSPORT
Hypersonic flow around flat body in case of intense radiative heat exchange N84-22795
RADIATIVE TRANSFER
Spectroradiometric calibration of the Thematic Mapper and multispectral scanner system
[E84-10098] N84-23000
Sensor radiance for a midlatitude atmospheric model N84-23001
In-flight absolute radiometric calibration of the Thematic Mapper — White Sands, New Mexico N84-23002
RADIO BURSTS
Quenchings and outbursts of extragalactic radio sources: Nine years of 3.3-mm measurements and comparisons with centimeter-wave variations
[AD-A138233] N84-23550
RADIO COMMUNICATION
Jam-resistant tactical communications N84-22828
RADIO EQUIPMENT
The CARFAX road traffic information system
[BBC-RD-1984/1] N84-22818
RADIO FREQUENCIES
RF properties of superconducting A-15 compounds
[AD-A139067] N84-23285
Study of variability in extragalactic radio sources at 22 GHz and 44 GHz
[INPE-2913-TDL/149] N84-23549
RADIO FREQUENCY HEATING
A rf-induced stability of mirrors with inverted pressure profiles
[DE84-007018] N84-23273
RADIO FREQUENCY INTERFERENCE
New formulas for HED (Horizontal Electric Dipole), HMD (Horizontal Magnetic Dipole), VED (Vertical Electric Dipole), and VMD (Vertical Magnetic Dipole) subsurface-to-subsurface propagation
[AD-A139030] N84-23187
RADIO RECEIVERS
Performance evaluation of a Magnavox GPS (Global Positioning System) Z-set
[AD-A136569] N84-22547
RADIO SPECTROSCOPY
An absolute calibration method for electron cyclotron emission spectrometers
[REPT-83-149] N84-22941
RADIOACTIVE AGE DETERMINATION
Geology and geochronology of the southeast border of the Bitterroot Dome: Implications for the structural evolution of the Mylonitic Carapace N84-23065
RADIOMETERS
Method and apparatus for precision control of radiometer
[NASA-CASE-NPO-15398-1] N84-22931
RADIOMETRIC RESOLUTION
Spectroradiometric calibration of the Thematic Mapper and multispectral scanner system
[E84-10098] N84-23000
Sensor radiance for a midlatitude atmospheric model N84-23001
In-flight absolute radiometric calibration of the Thematic Mapper — White Sands, New Mexico N84-23002
LANDSAT 4 band 6 data evaluation
[E84-10119] N84-23009
RAIN
Study of the 13 GHz signal attenuation due to tropical rains
[CRPE-NT-113] N84-22879
Analysis of propagation conditions at 20 and 30 GHz in Europe
[CRPE-NT-122] N84-22880
Estimating monthly rainfall from geostationary satellite imagery over Amazonia, Brazil N84-23069
Cognitive performance change during a 6-hour hike at low temperature in simulated rain, at controlled walking rates
[AD-A138358] N84-23100
RAMAN SPECTROSCOPY
Optical gas temperature measurement in gas turbines
[PNR-90174] N84-22572
Theoretical calculation of H/sub 2 S- and Q-branch spectra for propellant flames N84-22636
CARS studies of nitramine LOVA propellant combustion N84-22683
Observation of surface-enhanced Raman scattering for transition-metal hexaammine cations at the outer Helmholtz plane: Implications for enhancement mechanisms at electrochemical interfaces
[AD-A139045] N84-22719
Surface-enhanced Raman spectroscopy of electrochemically characterized interfaces. Relations between Raman scattering intensity and surface coverage for simple anionic adsorbates
[AD-A139054] N84-22721
RAMJET ENGINES
Particle sizing in a fuel rich airbreathing engine combustor N84-22634
Three-dimensional, primitive-variable model for solid-fuel ramjet combustion N84-22688
Heterogeneous diffusion flame stabilization: Constant density results N84-22689
Detailed flow measurements in fuel-rich, particle-laden plumes N84-22690
Three-dimensional, primitive-variable model for solid-fuel ramjet combustion
[AD-A138756] N84-22715
Mixing of swirling flows and behavior of wet flows
[AD-A138697] N84-22915
RANKING
Quantification of subjective ratings through conjoint measurement analysis
[AD-A138810] N84-22554
An evaluation of ARIADNE (alternative ranking interactive aid based on dominance structure information elicitation)
[AD-P002891] N84-22852
RATINGS
Personnel technology: Performance appraisal, a process approach
[AD-A138359] N84-23112
RAWINSONDES
A statistical evaluation and comparison of VISSR Atmospheric Sounder (VAS) data and corresponding rawinsonde measurements
[NASA-TM-82575] N84-23071
RAYLEIGH WAVES
A review study of nondestructive test techniques for residual stresses in aircraft transparencies
[AD-A138930] N84-22555
Coupling of airborne sound in a sandy soil — containing seismic sensors
[LEOK-TR-1983-09] N84-23238

RDX
CARS studies of nitramine LOVA propellant combustion N84-22683
REACTION KINETICS
Nitramine propellant ignition under rapid gas loading conditions N84-22677
Kinetics of the Beta + Delta phase transformation of HMX N84-22681
Modeling the self-deflagration of HMX N84-22682
Three-dimensional, primitive-variable model for solid-fuel ramjet combustion N84-22688
Theoretical influence of the deposition conditions on the uniformity of boron carbide coatings N84-22707
Three-dimensional, primitive-variable model for solid-fuel ramjet combustion
[AD-A138756] N84-22715
Utility of surface reaction entropies for examining reactant-solvent interactions at electrochemical interfaces. Ferricinium-ferrocene attached to platinum electrodes
[AD-A139055] N84-22722
Investigations of radical-radical reactions using a far infrared Laser Magnetic Resonance (Fir-LMR) spectrometer
[MPIS-4/1983] N84-22730
Characterization of zirconium alloy oxidation films by alternating current impedance
[DE84-006225] N84-22766
Resistance characterization of nickel sulfide electrodes in LiCl-containing molten salt electrolytes
[DE84-006734] N84-22898
Kinetic studies of atmospheric reactions of OH radicals N84-23050
Kinetics and products of the reaction OH + HNO3 N84-23051
Intramolecular electron transfer at metal surfaces. 3: Influence of bond conjugation on reduction kinetics of Cobalt (3) anchored to metal surfaces via thiophenecarboxylate ligands
[AD-A139066] N84-23242
Primary patterns of electronically excited molecules in the gas phase 2
[MPIS-9/1983] N84-23245
An experimental estimate of the electron-tunneling distance for some outer-sphere electrochemical reactions
[AD-A139049] N84-23284
Thermodynamics and kinetics of the gas phase and pack aluminide coating formation on iron and steel N84-23291
The reaction NH2 + PH3 yields NH3 + PH2: Absolute rate constant measurement and implication for NH3 and PH3 photochemistry in the atmosphere of Jupiter
[NASA-TM-85063] N84-23430
REACTION PRODUCTS
Primary patterns of electronically excited molecules in the gas phase 2
[MPIS-9/1983] N84-23245
Experiments on water/melt explosions, nature of products, and models of dispersal N84-23483
REACTOR TECHNOLOGY
Moving ring reactor KARIN-I
[IPPJ-660] N84-23265
READERS
Documentation for the machine-readable version of the Survey of the Astrographic Catalogue From 1 to 31 Degrees of Northern Declination (Fresneau 1983)
[NASA-TM-85569] N84-23421
REAL TIME OPERATION
Testing and error analysis of a real-time controller N84-23144
The simple roots of real-time computation hierarchies (preliminary version)
[MC-IW-244/83] N84-23203
Real-time implementation of nonlinear optical processing functions
[AD-A138843] N84-23256
RED SHIFT
Documentation for the machine-readable version of a table of Redshifts for Abell clusters (Sarazin, Rood and Struble 1982)
[NASA-TM-85571] N84-23417
REDUCTION (CHEMISTRY)
Intramolecular electron transfer at metal surfaces. 2: Comparisons of ligand-bridged CR(3) reduction kinetics at silver versus mercury electrodes
[AD-A139047] N84-22720
Intramolecular electron transfer at metal surfaces. 3: Influence of bond conjugation on reduction kinetics of Cobalt (3) anchored to metal surfaces via thiophenecarboxylate ligands
[AD-A139066] N84-23242
REFERENCE SYSTEMS
Documentation for the machine-readable version of the catalogue of 20457 Star positions obtained by photography in the declination zone -48 deg to -54 deg (1950)
[NASA-TM-85572] N84-23416
REFLECTOMETERS
Measuring roughness of ultrasmooth surfaces by reflectometric method N84-22807
REFRACTORY METALS
Absorbable-susceptor joining of ceramic surfaces
[NASA-CASE-NPO-15640-1] N84-22748
REGENERATIVE FUEL CELLS
Design considerations for a 10-kW integrated hydrogen-oxygen regenerative fuel cell system
[NASA-TM-83664] N84-23023
REGOLITH
Geologic studies of outer solar system satellites: Iapetus and Europa N84-23448
REGRESSION ANALYSIS
A comparison of several alternatives to maximum likelihood for the Weibull distribution
[AD-A139721] N84-23208
A regression model for the temporal development of soil pipes and associated gullies in the alluvial-fill valley of the Rio Puerco, central New Mexico N84-23502
REGULATIONS
Needed help for the Federal Acquisition Regulation Council
[AD-P002769] N84-23318
Nailing down the liability issue once and for all
[AD-P002777] N84-23324
RELATIVISTIC EFFECTS
The beam-density effect on energy loss of a relativistic charged particle beam
[AD-A139051] N84-23241
RELATIVISTIC ELECTRON BEAMS
Physics of high temperature, dense plasmas
[AD-A138872] N84-23268
RELATIVITY
Activities report of the Institute of Astronomy N84-23422
RELAXATION (MECHANICS)
Dynamical relaxation in stellar systems N84-23426
RELIABILITY
Current research in the Software Engineering Laboratory (SEL) N84-23138
Empirical analysis of a token ring network
[AD-A138905] N84-23164
Assessment of the NASA Flight Assurance Review Program
[NASA-CR-173418] N84-23401
RELIABILITY ANALYSIS
An assessment of the reliability of edge connectors --- circuit boards
[ERA-82-22] N84-22888
SIRE: An integrated reliability and cost model for the aerospace industry --- System Integrated Reliability Evaluator (SIRE)
[PNR-90192] N84-22972
Structural coverage of functional testing N84-23141
RELIABILITY ENGINEERING
Cost effectiveness of reliability in the aerospace industry
[PNR-90187] N84-22971
Engine product performance agreements and the future
[AD-P002821] N84-23366
REMOTE CONTROL
Advances in solid state switchgear technology for large space power systems
[NASA-TM-83652] N84-22891
REMOTE SENSING
Evaporation from a bare soil evaluated from a soil water transfer model using remotely sensed surface soil moisture data
[CRPE-NT-125] N84-23016
Topex: Observing the oceans from Space
[NASA-CR-173490] N84-23085
Characterization of surficial geologic units on Venus from Pioneer Venus radar data: A progress report N84-23454
REMOTELY PILOTED VEHICLES
Preliminary experience with a stereoscopic video system in a remotely piloted aircraft application
[NASA-TM-84909] N84-22557
REPORTS
Assessment of the NASA Flight Assurance Review Program
[NASA-CR-173418] N84-23401
RESEARCH AND DEVELOPMENT
Technology review of flight crucial flight controls
[NASA-CR-172332] N84-22583
Current trends in atomic spectroscopy
[PB84-162957] N84-22732
Scientific activity in hydrology, 1979-1982 N84-23010
West Europe report: Science and technology
[JPRS-WST-84-011] N84-23224
Magnetic fusion energy research and development
[DE84-007069] N84-23270
Strengthening small business participation in Department of Defense extramural research and development
[AD-P002832] N84-23377
USSR report: Science and technology policy
[JPRS-UST-84-004] N84-23387
Use of economic mechanisms in managing scientific and technical progress N84-23389
Prerequisites for scientific-technical progress enumerated N84-23395
RESEARCH MANAGEMENT
A survey of European robotics research
[AD-A138952] N84-23122
Thomson semiconductors bipolar IC strategy to 1986 N84-23227
Assumption of risk in the R and D environment
[AD-P002757] N84-23304
Closing the gap between R and D and application in academe to better support government and industry
[AD-P002761] N84-23308
New initiatives in international programs
[AD-P002813] N84-23359
Strengthening small business participation in Department of Defense extramural research and development
[AD-P002832] N84-23377
Air Force Systems Command research planning guide (research objectives)
[AD-A138851] N84-23384
RESIDUAL STRESS
A review study of nondestructive test techniques for residual stresses in aircraft transparencies
[AD-A138930] N84-22555
RESINS
Fire and heat resistant laminating resins based on maleimido substituted aromatic cyclotriphosphazenes
[NASA-CASE-ARC-11428-1] N84-22697
RESISTANCE
Acoustic ground impedance meter
[NASA-CASE-LAR-12995-1] N84-22933
RESONANCE SCATTERING
Investigation of non-linear estimation of natural resonances in target identification
[AD-A139027] N84-22578
RESONANT FREQUENCIES
Low noise tuned amplifier
[NASA-CASE-GSC-12567-1] N84-22887
Acoustic ground impedance meter
[NASA-CASE-LAR-12995-1] N84-22933
Effects of transverse loading on the thickness shear resonance frequencies in crystal plates N84-22994
The Laplacian resonance and tidal dissipation N84-23434
RESONANT VIBRATION
System for torque control of unbalanced rotor during passage through resonance N84-22902
RESOURCES
Two-step industrial preparedness planning: Balancing funds and production capability
[AD-P002802] N84-23348
RESOURCES MANAGEMENT
Scientific activity in hydrology, 1979-1982 N84-23010
Impact of corporate resource allocation decisions on national security objectives: Disynergism in aerospace industrial resource planning
[AD-P002801] N84-23347
Improved management of support resources
[AD-P002808] N84-23354
USSR report: Science and technology policy
[JPRS-UST-84-007] N84-23391
Beyond the data base: Technology for information resource management
[AD-A138840] N84-23402
REVIEWING
The Shock and Vibration Digest, volume 16, no. 3
[AD-A139707] N84-22976
REYNOLDS NUMBER
Combustion performance of a vitiated air heater for a freejet test facility N84-22691
RHEOLOGY
The 1950 sulfur flow of Mauna Loa: Considerations for Io N84-23479
RIDGES
Ridges on basalt flows N84-23484
RIGID STRUCTURES
Application of control theory to large flexible structures using the independent modal-space control method N84-22617
Biaxial orientation and mechanical properties of amorphous polymers N84-22965
RING LASERS
Anomalous laser induced bunch lengthening on the ACO storage ring free electron laser
[AD-A138814] N84-22949

RING STRUCTURES
Ring spacing of Mercurian multi-ring basins and basin ring formation N84-23464
RINGS
Study of large viscoplastic strains in cylindrical shells by method of magnetic-pulse loading N84-22798
New theory for thick, composite-material rings [AD-A139536] N84-22981
RIPPLES
Surface wave propagation over sinusoidally varying topography: Theory and observation [IOS-159-PT-1] N84-22922
Surface wave propagation over sinusoidally varying topography: Theory and observation [IOS-159-PT-2] N84-22923
RISK
Cost risk trade-offs in timing the production decision [AD-P002753] N84-23300
Managing program risk: One way to reduce cost growth [AD-P002754] N84-23301
DECISION TECHNOLOGY: The catalyst for acquisition improvement [AD-P002755] N84-23302
Designing the equitable risk contract [AD-P002756] N84-23303
Assumption of risk in the R and D environment [AD-P002757] N84-23304
Cost risk and contract type: A normative model [AD-P002761] N84-23328
An application of the causal-integrative model [AD-P002766] N84-23333
Risk analysis: Comparing different contract types [AD-P002768] N84-23335
RIVERS
Experimental investigations of rivulet meanders --- flow instability [MPIS-5/1983] N84-23015
Experiments examining the shapes of isolated bars in comparison with those occurring in braided rivers N84-23503
ROBOTICS
Adaptive control strategies for computer-controlled manipulators N84-23114
A survey of European robotics research [AD-A138952] N84-23122
Computer methods for industrial automation and robotics N84-23168
The impact of factory automation and robotics on the contracting and acquisition processes [AD-P002630] N84-23375
ROBUSTNESS (MATHEMATICS)
Robustness and sensitivity of Smith predictor controllers for time-delay systems [RR-238] N84-22812
A comparison of several alternatives to maximum likelihood for the Weibull distribution [AD-A139721] N84-23206
ROCKET ENGINES
Tangential mode instability in double-base solid rocket motors: A case study N84-22652
Very low thrust gaseous oxygen-hydrogen rocket engine ignition technology N84-22692
ROCKET EXHAUST
The 14th JANNAF Plume Technology Meeting, volume 1 [AD-A139654] N84-22619
MMH-nitrate and plume deposits from NTO/MMH engines N84-22620
Application of the CONTAM 3 computer model to the prediction of heating, forces, and contamination on a communications satellite N84-22621
CONTAM 3 plus improved CONTAM 3 usability N84-22622
Solid carbon oxidation and radiation in exhaust plumes N84-22623
Multiple point source model for three dimensional plume flow fields N84-22625
Operational update to the RCS flow field of the space shuttle orbiter N84-22626
Aircraft exhaust plume signature predictions for non-axisymmetric multiple engine installations N84-22627
Mach number and density effects in the mixing of supersonic jets N84-22628
Theoretical predictions of excitation cross sections for collisions of HF, HCl, CO, H2O, and CO2 with O(P-3) N84-22630
ROCKET NOZZLES
Three-dimensional, two-phase supersonic nozzle flows [AD-A138649] N84-22538
ROCKET-BORNE PHOTOGRAPHY
A normal incidence, high resolution X-ray telescope for solar coronal observations [NASA-CR-173518] N84-23412
ROCKS
Weathered stony meteorites from Victoria Land, Antarctica, as possible guides to rock weathering on Mars N84-23509
ROLL FORMING
The heat treatment response of thermomechanically processed M-50 steel [AD-A138571] N84-22736
ROLLER BEARINGS
Engine reliability through bearing condition monitoring --- aircraft engines [PNR-90168] N84-22570
ROTARY STABILITY
System for torque control of unbalanced rotor during passage through resonance N84-22802
Approach to solving problem of acoustic wave diffraction by elastic shell N84-22804
Balancing of flexible rotors with simultaneous precise determination of influencing factors N84-22808
ROTARY WING AIRCRAFT
Variable stator radial turbine [NASA-CR-174663] N84-22568
ROTATING BODIES
Central burst of simultaneously rotating and gravitating body N84-22783
ROTATION
Energetics of vortex ring formation [AD-A138795] N84-22539
Effect of rotation on thermal state of runner blade through effect on heat transfer on coolant side N84-22787
Sedimentary response to eocene tectonic rotation in western Oregon N84-23063
Acoustic rotation control [NASA-CASE-NPO-15689-1] N84-23233
ROTOR AERODYNAMICS
Nonlinear/transient rotor dynamics analysis N84-22977
ROTOR BLADES (TURBOMACHINERY)
Tip cap for a rotor blade [NASA-CASE-LEW-13654-1] N84-22560
Oxidizing seal for a turbine tip gas path [NASA-CASE-LEW-14053-1] N84-22563
Heat transfer in serpentine passages with turbulence promoters [NASA-TM-83614] N84-22911
Nonlinear/transient rotor dynamics analysis N84-22977
Fan noise reduction achieved by removing tip flow irregularities behind the rotor - forward arc test configurations [NASA-TM-83616] N84-23235
A high temperature optical displacement measuring system --- gas turbine blades [PNR-90186] N84-23261
ROTOR SPEED
Approach to solving problem of acoustic wave diffraction by elastic shell N84-22804
ROTORS
Dual clearance squeeze film damper [NASA-CASE-LEW-13506-1] N84-22562
System for torque control of unbalanced rotor during passage through resonance N84-22802
Approach to solving problem of acoustic wave diffraction by elastic shell N84-22804
Balancing of flexible rotors with simultaneous precise determination of influencing factors N84-22808
Wind power generation design considerations [AD-A138841] N84-23029
Performance and size estimating for wind systems foi MF [DE84-006980] N84-23033
RUBBER
Effect of pressure on the static and dynamic acoustic properties of porous rubber [AD-A138744] N84-22756
RUTHENIUM COMPOUNDS
Use of a polyacetylene cathode in primary lithium-thionyl chloride cells [AD-A138791] N84-22896

S

SAFETY
Phosphorus-containing imide resins [NASA-CASE-ARC-11368-3] N84-22745
SAFETY FACTORS
Device and method for frictionally testing materials for ignitability [NASA-CASE-MSC-20622-1] N84-22596
SALINITY
Airborne lidar for oceanography and hydrology (FLOH) [ESA-TT-799] N84-22955
Salts in the dry valleys of Antartica N84-23510
SAMPLING
Boron in the marine atmosphere N84-23038
SANDS
Wind erosion and dune formation on high frozen bluffs N84-23493
SATELLITE ATMOSPHERES
Titan exploration with advanced systems. A study of future mission concepts [NASA-CR-173499] N84-22583
SATELLITE ATTITUDE CONTROL
Very low thrust gaseous oxygen-hydrogen rocket engine ignition technology N84-22692
SATELLITE IMAGERY
Estimating monthly rainfall from geostationary satellite imagery over Amazonia, Brazil N84-23069
Volcanism in the Valles Marineris N84-23480
The Galilean Satellite Geological Mapping Program, 1983 N84-23541
SATELLITE NETWORKS
Testing and error analysis of a real-time controller N84-23144
SATELLITE OBSERVATION
Topex: Observing the oceans from Space [NASA-CR-173490] N84-23085
Comparison of Hapke's photometric theory with Voyager observations of Europa, Enceladus, Rhea and Mimas N84-23439
Characterization of surficial geologic units on Venus from Pioneer Venus radar data: A progress report N84-23454
SATELLITE SURFACES
Geologic studies of outer solar system satellites: Iapetus and Europa N84-23448
The 1950 sulfur flow of Mauna Loa: Considerations for Io N84-23479
SATELLITE TRANSMISSION
Analysis of propagation conditions at 20 and 30 GHz in Europe [CRPE-NT-122] N84-22880
SATURN (PLANET)
Origin and evolution of the Saturn system N84-23433
Cratering history of the Saturnian satellites N84-23473
SATURN SATELLITES
Origin and evolution of the Saturn system N84-23433
Geology of Dione N84-23444
Cratering history of the Saturnian satellites N84-23473
SCALING LAWS
Quantification of subjective ratings through conjoint measurement analysis [AD-A138810] N84-22554
SCANNERS
Two-dimensional scanner apparatus --- flaw detector in small flat plates [NASA-CASE-MFS-25687-1] N84-22928
Electronic scanning pressure measuring system and transducer package [NASA-CASE-ARC-11361-1] N84-22934
Programmable scan/read circuitry for charge coupled device imaging detectors --- spacecraft attitude control and star trackers [NASA-CASE-NPO-15345-1] N84-23247
SCATTERING
Inversion of experimental optical data [AD-A138979] N84-23257
SCATTERING CROSS SECTIONS
Theoretical predictions of excitation cross sections for collisions of HF, HCl, CO, H2O, and CO2 with O(P-3) N84-22630
Calculation procedures for variational, Born and exact solutions for electromagnetic scattering from two randomly separated dielectric Rayleigh cylinders [AD-A138543] N84-22665
SCATTEROMETERS
Study of wind scatterometer antenna for ERS-1. Volume 1: Executive summary report [Y/A-3380] N84-23080
Study of windscatterometer antenna for ERS-1 [MIX/A-3188] N84-23081
SCENE ANALYSIS
Machine vision: Three generations of commercial systems [AD-A139037] N84-23123
SCHEDULING
Definition of technology development missions for early space stations. Large space structures, phase 2, midterm review [NASA-CR-171004] N84-22607
SCHMIDT TELESCOPES
Dual aperture multispectral Schmidt objective [NASA-CASE-GSC-12756-1] N84-23248
A survey of halo RR Lyrae stars N84-23409

SCIENTISTS
Report of the DOD-University forum working group on engineering and science education
[AD-A138205] N84-23292
Problems of prompt adoption of new technology discussed N84-23396
Landmarks of progress N84-23397
SCORING
The Score technique: An analytical approach for assessing the results of manufacturing reviews
[AD-P002838] N84-23383
SCREW DISLOCATIONS
Fracture toughness processes
[DE84-007244] N84-22969
SEALS (STOPPERS)
Process for preparing perfluorotriazine elastomers and precursors thereof
[NASA-CASE-ARC-11402-1] N84-22744
Method of fabricating an abradable gas path seal
[NASA-CASE-LEW-13269-2] N84-22957
Factors influencing thermomechanical failure of face seals, 3
[AD-A138546] N84-22961
SEASAT 1
Propagation effects in satellite-based synthetic aperture radars
[AD-A138681] N84-22873
SEAT BELTS
Effects of a negative G strap on restraint dynamics and human impact response
[AD-A138642] N84-23121
SEDIMENT TRANSPORT
Long range transport of fine grained sediments on Mars: Atmospheric dust loading, as inferred from Viking Lander imaging data N84-23468
A possible source for the Martian circumpolar dune material N84-23490
Velocities of windblown particles in saltation: Venus, Earth, and Mars N84-23491
SEDIMENTARY ROCKS
Sedimentary response to eocene tectonic rotation in western Oregon N84-23083
SEDIMENTS
Valles Marineris layered deposits: Implications of origin N84-23537
SEISMIC WAVES
Acoustic-to-Seismic coupling over porous ground surfaces
[AD-A138753] N84-23046
Chronology, morphology and stratigraphy of pumiceous pyroclastic-flow (ignimbrite) deposits from the eruption of Mount St. Helens on 18 May 1983 N84-23476
SELF DIFFUSION (SOLID STATE)
Measurement and calculation of parameters in the silox diffusion process — semiconductor devices
[EUT-83-E-133] N84-23289
SELF SEALING
Oxidizing seal for a turbine tip gas path
[NASA-CASE-LEW-14053-1] N84-22563
SEMANTICS
Compactness in semantics for merge and fair merge
[MC-IW-238/83] N84-23199
Process algebra semantics for queues
[MC-IW-241/83] N84-23219
SEMICONDUCTOR DEVICES
The development and fabrication of an implantable, multiplexed, semiconductor multielectrode array
[AD-A138788] N84-22895
Measurement and calculation of parameters in the silox diffusion process — semiconductor devices
[EUT-83-E-133] N84-23289
SEMICONDUCTOR DIODES
Deep level impurities in germanium and silicon: Low temperature passivation or removal techniques
[DE84-006772] N84-23286
SEMICONDUCTORS (MATERIALS)
Advances in solid state switchgear technology for large space power systems
[NASA-TM-83652] N84-22891
Photoelectrochemical cells including chalcogenophosphate photoelectrodes
[NASA-CASE-LAR-12958-1] N84-23019
SENSITIVITY
Liquid-phase photoionization detector for liquid chromatography N84-22711
SENSORS
Characterization of humidity sensors and physical properties of h20
[AD-A139024] N84-22938
SEPARATED FLOW
ALESEP: A computer program for the analysis of airfoil leading edge separation bubbles
[NASA-CR-172310] N84-22537
Separation flow past bodies with fixed separation sites N84-22784
SEPARATORS
Separator development and testing of nickel-hydrogen cells
[NASA-TM-83653] N84-22712
SEQUENTIAL CONTROL
Method for sequentially processing a multi-level interconnect circuit in a vacuum chamber
[NASA-CASE-MFS-256704-1] N84-22884
SERIES (MATHEMATICS)
On a fundamental inequality and the singularities of an analytic function defined by the LC-Dirichletian element N84-23177
SERVICE LIFE
Tip cap for a rotor blade
[NASA-CASE-LEW-13654-1] N84-22560
Mortality and spareparts: A conceptual analysis
[AD-P002826] N84-23371
SERVOMECHANISMS
Disturbance minimization techniques for linear, time-invariant dynamical systems
[AD-A138915] N84-23185
SET THEORY
A unified approach to modeling and combining of evidence through random set theory
[AD-P002880] N84-22841
Thin sets in nonlinear potential theory N84-23178
Connectivity of circulant digraphs
[MC-BW-186/83] N84-23220
SEWING
Preliminary results of the effects of sewing, packing and parachute deployment on material strength
[DE84-006464] N84-22541
SHADOWS
Thermodynamic model for a central receiver of a solar plant with partial shading of the heliostat field
[ESA-TT-807] N84-23034
Theoretical aspects of photoclinometric terrain profiling on the Galilean satellites N84-23441
SHALE OIL
Alternate fuels combustion research
[AD-A138575] N84-22769
Oil shale extraction using super-critical extraction
[NASA-CASE-NPO-15656-1] N84-23012
SHAPES
Electromagnetic radiation and scattering from a system of conducting bodies interconnected by wires N84-22882
Attitude and shape control of large space structures N84-23091
Light transmitting window assembly
[NASA-CASE-MSC-18417-1] N84-23251
Experiments examining the shapes of isolated bars in comparison with those occurring in braided rivers N84-23503
SHEAR
Effect of pressure on the mechanical properties of polymers, part 1
[DE84-006311] N84-22765
SHEAR STRENGTH
Revision of design values for 7075-T7351 and 7075-T7651 aluminum plate
[AD-A139092] N84-22740
SHIPS
Comparisons of sea-surface temperature obtained from ship and satellite data
[AD-A138257] N84-23087
SHOCK ABSORBERS
Evaluation of 'Sorbothane' cushioning material
[AD-A139079] N84-22763
State space method for optimal design of shock absorbers with floating boundaries N84-22966
SHOCK LAYERS
Three-dimensional nonequilibrium viscous shock-layer flow over the Space Shuttle orbiter N84-22530
Three-dimensional nonequilibrium viscous shock-layer flows over complex reentry vehicles N84-22543
SHOCK LOADS
The Shock and Vibration Digest, volume 16, no. 3
[AD-A139707] N84-22976
SHOCK RESISTANCE
Method of fabricating an abradable gas path seal
[NASA-CASE-LEW-13269-2] N84-22957
SHOCK TUBES
A shock tube study of chlorine azide decomposition N84-22728
SHOCK WAVE INTERACTION
Mixing of swirling flows and behavior of wet flows
[AD-A138697] N84-22915
Coupling of airborne sound in a sandy soil — containing seismic sensors
[LEOK-TR-1983-09] N84-23238
SHOCK WAVE PROPAGATION
Discrete charge diagnostics on Pre-DIRECT COURSE
[AD-A139073] N84-22919
SHOCK WAVES
Shock consolidation of powders: Theory and experiment
[DE84-007273] N84-22741
Exact solution to problem of interaction between wedge moving at supersonic velocity and interface of two gaseous media N84-22790
An analysis of shock coalescence including three-dimensional effects with application to sonic boom extrapolation
[NASA-TP-2214] N84-22906
The onset of detonation behind incident shock waves in chlorine azide-argon mixtures N84-22921
Underwater shock-induced responses of submerged cylindrical structures
[AD-A139072] N84-22967
Shock waves and mass outflow in the Orion molecular cloud: Observations of far-infrared emission lines of carbon monoxide, hydroxyl and ammonia N84-23423
SHORT TAKEOFF AIRCRAFT
Experimental investigation of the internal flow field in STOL engine inlets N84-22544
Development and analysis of a STOL supersonic cruise fighter concept
[NASA-TM-85777] N84-22553
SHROUDS
Method of fabricating an abradable gas path seal
[NASA-CASE-LEW-13269-2] N84-22957
SICILY
Effusion rate, length, and area relationships for some lava flows on Hawaii and Mount Etna with planetary implications N84-23482
SIDELOBE REDUCTION
Sidelobe cancelling techniques used in wideband systems N84-22822
SIGNAL DETECTION
Undersea sound speed and range estimation
[AD-A138954] N84-23237
SIGNAL DISTORTION
Study and design of a cylindrical lens array antenna for wideband electronic scanning
[AD-A138808] N84-22875
SIGNAL PROCESSING
Real time pressure signal system for a rotary engine
[NASA-CASE-LEW-13622-1] N84-22559
Computer controlled laser optoacoustic spectroscopy for trace gas analysis N84-22710
Research Trends in Military Communications
[AD-A138229] N84-22821
Enhancement of spread-spectrum systems through adaptive antenna techniques N84-22824
Jam-resistant tactical communications N84-22828
Spread spectrum networks N84-22831
Generalized adaptive node concept N84-22833
A digital adaptive array processing algorithm for communications N84-22834
Signal processing circuit development
[AD-A138648] N84-22870
Nearly optimal detection of signals in non-Gaussian noise
[AD-A138857] N84-22872
Environmental qualification tests, signal conditioning unit, SD602 materials experiment
[AD-A138910] N84-22997
Adaptive hybrid picture coding
[AD-A138876] N84-23184
Undersea sound speed and range estimation
[AD-A138954] N84-23237
Real-time implementation of nonlinear optical processing functions
[AD-A138843] N84-23256
SIGNAL TO NOISE RATIOS
Target super-resolution compensation for coherent airborne radar utilizing spread spectrum waveforms
[AD-A138545] N84-22866
Evaluation of the comprehension of non-continuous, sped-up vocoded speech: A strategy for coping with fading HF (High Frequency) channels
[AD-A138650] N84-22871
SIGNAL TRANSMISSION
Navigation system and method
[NASA-CASE-GSC-12508-1] N84-22546
Doppler radar having phase modulation of both transmitted and reflected return signals
[NASA-CASE-MSC-18675-1] N84-22820
Transmitting two-level balanced code within the bandwidth of straight binary code-transmission N84-23231
SILICON
Bulk formation of metallic glasses and amorphous silicon from the melt
[NASA-CR-171012] N84-22752
The effect of diffusion induced lattice stress on the open-circuit voltage in silicon solar cells
[NASA-TM-83667] N84-23027

SILICON CARBIDES
Contact-stress analysis of elastic-viscoelastic interface conditions
[AD-A138834] N84-22759
SILICON DIOXIDE
Measurement and calculation of parameters in the silox diffusion process — semiconductor devices
[EUT-83-E-133] N84-23289
SILICON FILMS
Plasma-initiated laser deposition of polycrystalline and monocrystalline silicon films
[DE84-005527] N84-22953
SILICONES
Thermal endurance of silicone/glass sleeving by the cyclic electrical proof test method of IEC 216 (first report)
[ERA-82-91] N84-22967
Thermal endurance of silicone/glass sleeving by the cyclic electrical proof test method of ICC 216 (second report)
[ERA-82-136] N84-22968
SIMULATION
closed bomb combustion simulation of Hivelite solid propellant N84-22667
Is there radar evidence for liquid water on Mars? N84-23529
SINGLE CRYSTALS
Plasma-initiated laser deposition of polycrystalline and monocrystalline silicon films
[DE84-005527] N84-22953
Ferroelectric tungsten bronze bulk crystals and epitaxial thin films for electro-optic device applications
[AD-A138693] N84-23278
Characterization of single crystal Cu/sub 2S/CdS heterojunctions by hing resolution electron microscopy
[DE84-006761] N84-23287
SINTERING
Method of making a light weight battery plaque
[NASA-CASE-LEW-13349-1] N84-22734
SITE SELECTION
Wind power generation design considerations
[AD-A138641] N84-23029
SIZE (DIMENSIONS)
Performance and size estimating for wind systems foi MF
[DE84-006980] N84-23033
SKIN (STRUCTURAL MEMBER)
Moisture transport in composites during repair work
[AD-A138658] N84-22703
SLENDER WINGS
Theory of hypersonic three-dimensional flow of nonsteady gas stream with relaxation past thin wing with arbitrary aspect ratio N84-22791
SLIDING FRICTION
Plane motion of solid body on rough surface of annular bearing rotating about its axis perpendicular to plane of motion N84-22801
SLOPES
Wind erosion and dune formation on high frozen bluffs N84-23493
Drainage evolution in the debris avalanche deposits near Mount Saint Helens, Washington N84-23496
SLOT ANTENNAS
Study of wind scatterometer antenna for ERS-1. Volume 1: Executive summary report
[Y/A-3360] N84-23080
Study of windscatterometer antenna for ERS-1
[MDC/A-3186] N84-23081
SLOTS
Slotted stick propellant study N84-22664
Closed vessel combustion studies of stick propellant N84-22665
SNELLS LAW
Non-destructive evaluation of composite materials using ultrasound
[NASA-CR-173416] N84-22969
SNOW
LANDSAT-D investigations in snow hydrology
[E84-10094] N84-22997
Atmospheric model development N84-22998
SODIUM CHLORIDES
Salts in the dry valleys of Antartica N84-23510
SOFTWARE ENGINEERING
Software Engineering Laboratory (SEL) data base reporting software user's guide and system description. Volume 1: Introduction and user's guide
[NASA-TM-85808] N84-23129
Software Engineering Laboratory (SEL) data base reporting software user's guide and system description. Volume 2: Program descriptions
[NASA-TM-85809] N84-23130
An approach to software cost estimation
[NASA-TM-85807] N84-23136
Proceedings of the Eighth Annual Software Engineering Workshop
[NASA-TM-85445] N84-23137
Current research in the Software Engineering Laboratory (SEL) N84-23138
Monitoring software development through dynamic variables N84-23139
Characteristics of a prototype experiment N84-23140
Examining functional acceptance testing with structural coverage metrics N84-23142
Testing and error analysis of a real-time controller N84-23144
Transformations of software design and code may lead to reduced errors N84-23145
Cleanroom certification model N84-23147
Projecting manpower to attain quality N84-23148
An approach to software baseline generation N84-23149
Documentation for software maintenance
[AD-A138663] N84-23152
Software engineering for user interfaces
[AD-A138937] N84-23155
SOFTWARE TOOLS
A survey of three language-independent programming environments
[MC-IW-240/83] N84-23160
Computer Aided Source Selection (CASS)
[AD-P002785] N84-23332
SOIL EROSION
Quantitative and experimental modelling of sapping networks N84-23500
Planetary geomorphology field studies: Washington and Alaska N84-23501
A regression model for the temporal development of soil pipes and associated gullies in the alluvial-fill valley of the Rio Puerco, central New Mexico N84-23502
Experiments examining the shapes of isolated bars in comparison with those occurring in braided rivers N84-23503
The erosion of streamlined islands, longitudinal grooves and scour marks: Implications to the origin of the Martian outflow channels N84-23504
SOIL MOISTURE
CONSERVB: A numerical method to compute soil water content and temperature profiles under a bare surface
[E84-10113] N84-23006
A microwave systems approach to measuring root zone soil moisture
[E84-10114] N84-23007
Evaporation from a bare soil evaluated from a soil water transfer model using remotely sensed surface soil moisture data
[CRPE-NT-125] N84-23016
Is there radar evidence for liquid water on Mars? N84-23529
SOILS
Incorporation of remotely sensed soil moisture data into a hydrologic runoff model N84-23017
Desert pavement study at Amboy, California N84-23492
SOLAR ARRAYS
Study of solar array switching power management technology for space power system
[NASA-CR-167890] N84-23021
A 37.5-kW point design comparison of the nickel-cadmium battery, bipolar nickel-hydrogen battery, and regenerative hydrogen-oxygen fuel cell energy storage subsystems for low Earth orbit
[NASA-TM-83651] N84-23022
Design and development of a hybrid tracker point focus fresnel passively cooled concentrator photovoltaic array
[DE84-006365] N84-23031
Manufacturing cost analysis for photovoltaic concentrator tracking structures
[DE84-006318] N84-23032
SOLAR CELLS
Radiation damage and defect behavior in ion-implanted, lithium counterdoped silicon solar cells
[NASA-TM-83646] N84-22890
The effect of diffusion induced lattice stress on the open-circuit voltage in silicon solar cells
[NASA-TM-83667] N84-23027
Design and development of a hybrid tracker point focus fresnel passively cooled concentrator photovoltaic array
[DE84-006365] N84-23031
Manufacturing cost analysis for photovoltaic concentrator tracking structures
[DE84-006318] N84-23032
Low-cost GaAs solar cell development
[AD-A138938] N84-23280
SOLAR COLLECTORS
Design and development of a hybrid tracker point focus fresnel passively cooled concentrator photovoltaic array
[DE84-006365] N84-23031
Manufacturing cost analysis for photovoltaic concentrator tracking structures
[DE84-006318] N84-23032
SOLAR CORONA
A normal incidence, high resolution X-ray telescope for solar coronal observations
[NASA-CR-173518] N84-23412
Origin and evolution of the Saturn system N84-23433
SOLAR ENERGY
Study of solar array switching power management technology for space power system
[NASA-CR-167890] N84-23021
SOLAR ENERGY CONVERSION
Study of systems and technology for liquid hydrogen production independent of fossil fuels
[NASA-CR-173422] N84-22768
Wind and solar powered turbine
[NASA-CASE-NPO-15496-1] N84-23018
SOLAR FLARES
On the rate of energy input in thermal solar flares
[AD-A138345] N84-23548
SOLAR FLUX
Photochemical modeling of the Earth's stratosphere N84-23058
SOLAR GENERATORS
Wind and solar powered turbine
[NASA-CASE-NPO-15496-1] N84-23018
Thermodynamic model for a central receiver of a solar plant with partial shading of the heliostat field
[ESA-TT-807] N84-23034
SOLAR MAXIMUM MISSION
Comet nucleus sample return mission
[NASA-CR-173501] N84-22592
SOLAR ORBITS
Comet nucleus sample return mission
[NASA-CR-173501] N84-22592
SOLAR SYSTEM
Activities report of the Institute for Extraterrestrial Physics N84-23407
Reports of planetary geology program, 1983
[NASA-TM-86246] N84-23431
Evolution of the Uranus-Neptune planetesimal swarm: Consequences for the Earth N84-23445
Does saturation cratering exist in the solar system? N84-23467
SOLAR WIND
Energetics of the magnetosphere, revised
[NASA-TM-86063] N84-23041
SOLAR X-RAYS
On the rate of energy input in thermal solar flares
[AD-A138345] N84-23548
SOLID PHASES
Effect of non-constant solid phase thermal properties on temperature sensitivity of solid propellant N84-22654
SOLID PROPELLANT COMBUSTION
An optical surface tracking device which determines a solid propellant's burning rate N84-22638
Measurement of solid propellant burning rates employing microwave techniques N84-22640
An investigation of experimental techniques for obtaining particulate behavior in metallized solid propellant combustion N84-22659
Conditions for inflammation of accumulated aluminum in the propellant combustion zone N84-22660
Combustion of high-aluminum-content propellants N84-22661
Continuum modeling of stick charge combustion N84-22662
Multi-dimensional, multiphase flow analysis of flamespreading in a stick propellant charge N84-22663
Slotted stick propellant study N84-22664
Closed vessel combustion studies of stick propellant N84-22665
Flash X-ray with image enhancement applied to combustion events N84-22666
closed bomb combustion simulation of Hivelite solid propellant N84-22667
Kinetics of the Beta + Delta phase transformation of HMX N84-22681
CARS studies of nitramine LOVA propellant combustion N84-22683
Combustion thermodynamics of some boron-nitrogen-hydrogen compounds N84-22684
Three-dimensional, primitive-variable model for solid-fuel ramjet combustion
[AD-A138756] N84-22715
SOLID PROPELLANT IGNITION
Conditions for inflammation of accumulated aluminum in the propellant combustion zone N84-22660
Nitramine propellant ignition under rapid gas loading conditions N84-22677
Ignitibility studies of LOVA propellants — low vulnerability gun propellants N84-22678
SOLID PROPELLANT ROCKET ENGINES
Insitu measurement of burning rate N84-22639
Computerized static firing analysis techniques of solid propellant rocket motors N84-22641

Rocket motor aeroacoustics N84-22642
Coupling between velocity oscillations and solid propellant combustion N84-22643
Fluid-dynamically coupled solid propellant combustion instability - cold flow simulation N84-22644
On the oscillatory flowfield in solid rocket motors N84-22645
Effect of oscillations upon velocity distributions in simulated solid propellant flow environments N84-22646
Three-dimensional vorticity procedure interactions in combustion instability analysis of solid propellant rocket motors N84-22647
Generation of vehicle wobbling by the unsteady flow field in a spinning solid propellant rocket motor N84-22648
Direct measurement of high frequency solid propellant response functions N84-22649
Analysis of acoustic chamber pressure oscillations in shuttle high-pressure SRB's N84-22651

SOLID PROPELLANTS
Effect of non-constant solid phase thermal properties on temperature sensitivity of solid propellant N84-22654
Continuum modeling of stick charge combustion N84-22662
Multi-dimensional, multiphase flow analysis of flamespreading in a stick propellant charge N84-22663
Slotted stick propellant study N84-22664
Closed vessel combustion studies of stick propellant N84-22665
closed bomb combustion simulation of Hivelite solid propellant N84-22667
Heterogeneous diffusion flame stabilization: Constant density results N84-22669

SOLID ROCKET BINDERS
Dependence of burning rate of AP-polymer sandwiches on thickness of the binder laminae N84-22653
Modeling effects of composition on the burn rates of nitrate ester-based energetic binders N84-22685

SOLID ROCKET PROPELLANTS
Computerized static firing analysis techniques of solid propellant rocket motors N84-22641
Dependence of burning rate of AP-polymer sandwiches on thickness of the binder laminae N84-22653

SOLID STATE DEVICES
Advances in solid state switchgear technology for large space power systems
[NASA-TM-83652] N84-22891

SOLID STATE LASERS
Bibliography of Soviet Laser Developments, Number 63, January-February 1983
[AD-A138742] N84-22948

SOLIDS
Temperature, concentration, and size measurements in turbulent reactive flows N84-22633

SOLUTIONS
A method for evaluating the surface concentrations of 2 like-charged ions simultaneously adsorbed at an electrode-solution interface
[AD-A139074] N84-22724

SOLVATION
Redox thermodynamics of surface-bound reactants. Illustrative behavior of Cobalt(3)/(2) macrobicyclic cage complexes
[AD-A139058] N84-22723

SOLVENTS
Supercritical solvent coal extraction
[NASA-CASE-NPO-15210-1] N84-22709
The influence of specific reactant-solvent interactions on intrinsic activation entropies for outer-sphere electron transfer reactions
[AD-A139061] N84-22725

SOMMERFELD APPROXIMATION
New formulas for HED (Horizontal Electric Dipole), HMD (Horizontal Magnetic Dipole), VED (Vertical Electric Dipole), and VMD (Vertical Magnetic Dipole) subsurface-to-subsurface propagation
[AD-A139030] N84-23187

SONAR
Individual differences in military decisionmaking: The classification performance of active sonar operators
[AD-P002685] N84-22646

SONIC BOOMS
An analysis of shock coalescence including three-dimensional effects with application to sonic boom extrapolation
[NASA-TP-2214] N84-22906

SOOT
Solid carbon oxidation and radiation in exhaust plumes N84-22623
Mechanism of soot formation in premixed C2H2/O2 flames N84-22727

SOUND LOCALIZATION
Parametric and nonparametric Fast Kalman echo cancellation N84-22901

SOUND TRANSMISSION
Undersea sound speed and range estimation
[AD-A138954] N84-23237

SOUND WAVES
Rocket motor aeroacoustics N84-22642
Coupling between velocity oscillations and solid propellant combustion N84-22643
Automatic elimination of static unbalance of rotor in anisotropic bearings N84-22803
Acoustic ground impedance meter
[NASA-CASE-LAR-12995-1] N84-22933
Acoustic-to-Seismic coupling over porous ground surfaces
[AD-A138753] N84-23048
Acoustic rotation control
[NASA-CASE-NPO-15689-1] N84-23233
A new eigenfunction expansion and its application to waveguide acoustics
[AD-A138946] N84-23236
Coupling of airborne sound in a sandy soil — containing seismic sensors
[LEOK-TR-1983-00] N84-23238

SOUTH AMERICA
Application of Magsat lithospheric modeling in South America. Part 1: Processing and interpretation of magnetic and gravity anomaly data
[E84-10115] N84-23008

SPACE ENVIRONMENT SIMULATION
Certification vibration tests, SD802 materials experiment
[AD-A138547] N84-22982

SPACE EXPLORATION
Cost estimation model for advanced planetary programs, fourth edition
[NASA-CR-173495] N84-22590
Advanced planetary studies
[NASA-CR-173496] N84-22591
Titan exploration with advanced systems. A study of future mission concepts
[NASA-CR-173499] N84-22593

SPACE FLIGHT
Cost estimation model for advanced planetary programs, fourth edition
[NASA-CR-173495] N84-22590

SPACE MISSIONS
Comet nucleus sample return mission
[NASA-CR-173501] N84-22592
Satellite Services Catalog: Tools and equipment
[NASA-TM-85627] N84-22597

SPACE OBSERVATIONS (FROM EARTH)
Geology of Maxwell Montes, Venus N84-23460

SPACE POWER REACTORS
Advanced nickel-hydrogen cell configuration study
[NASA-CR-173417] N84-22889
Design of a 1-kWh bipolar nickel hydrogen battery
[NASA-TM-83647] N84-23024

SPACE PROBES
Titan exploration with advanced systems. A study of future mission concepts
[NASA-CR-173499] N84-22593
Space probe/satellite ejection apparatus for spacecraft
[NASA-CASE-MFS-15429-1] N84-22609

SPACE PROCESSING
Certification vibration tests, SD802 materials experiment
[AD-A138547] N84-22982

SPACE RENDEZVOUS
Apparatus for releasably connecting first and second objects in predetermined space relationship
[NASA-CASE-MSC-18969-1] N84-22605

SPACE SHUTTLE MAIN ENGINE
Measurements of elastohydrodynamic film thickness, wear and tempering behavior of high pressure oxygen turbopump bearings
[NASA-CR-171008] N84-22960

SPACE SHUTTLE ORBITERS
Three-dimensional nonequilibrium viscous shock-layer flow over the Space Shuttle orbiter N84-22530
Pre-stressed thermal protection systems
[NASA-CASE-MSC-20254-1] N84-22601
Atmospheric turbulence simulation for Shuttle orbiter
[NASA-CR-171013] N84-22602
Constant force friction damper
[NASA-CASE-MSC-20505-1] N84-22611

SPACE SHUTTLE PAYLOADS
Advanced planetary studies
[NASA-CR-173496] N84-22591
Space station architecture, module, berthing hub, shell assembly, berthing mechanism and utility connection channel
[NASA-CASE-ARC-11505-1] N84-22612
Operations: update to the RCS flow field of the space shuttle orbiter N84-22626
Acoustic environmental accuracy requirements for response determination
[NASA-CR-171003] N84-23234

SPACE SHUTTLES
Satellite Services Catalog: Tools and equipment
[NASA-TM-85627] N84-22597

SPACE STATIONS
Advanced planetary studies
[NASA-CR-173496] N84-22591
Space station architecture, module, berthing hub, shell assembly, berthing mechanism and utility connection channel
[NASA-CASE-ARC-11505-1] N84-22612
Space Station Systems Technology Study. Volume 3: Technology and Advancement Program Plan
[NASA-CR-171016] N84-22613
Space Station Systems Technology Study. Volume 1: Executive summary
[NASA-CR-171014] N84-22614
Behavioral biology of mammalian reproduction and development for a space station
[NASA-CR-173493] N84-23092

SPACE TRANSPORTATION SYSTEM
Certification vibration tests, SD802 materials experiment
[AD-A138547] N84-22982

SPACE-TIME FUNCTIONS
Model reference adaptive control systems: The hybrid approach N84-23189

SPACEBORNE TELESCOPES
Dual aperture multispectral Schmidt objective
[NASA-CASE-GSC-12756-1] N84-23248

SPACECRAFT
Space probe/satellite ejection apparatus for spacecraft
[NASA-CASE-MFS-15429-1] N84-22609

SPACECRAFT CHARGING
Analysis of spacecraft charging, particle beams and geophysical data bases
[AD-A138632] N84-22618

SPACECRAFT COMPONENTS
Apparatus for releasably connecting first and second objects in predetermined space relationship
[NASA-CASE-MSC-18969-1] N84-22605
High voltage-high power components for large space power distribution systems
[NASA-TM-83648] N84-22615

SPACECRAFT CONFIGURATIONS
Space station architecture, module, berthing hub, shell assembly, berthing mechanism and utility connection channel
[NASA-CASE-ARC-11505-1] N84-22612

SPACECRAFT DESIGN
Optimization of thermal systems with sensitive optics, electronics, and structures
[NASA-CR-3745] N84-22608
Space station architecture, module, berthing hub, shell assembly, berthing mechanism and utility connection channel
[NASA-CASE-ARC-11505-1] N84-22612
Multiple point source model for three dimensional plume flow fields N84-22625

SPACECRAFT DOCKING
Apparatus for releasably connecting first and second objects in predetermined space relationship
[NASA-CASE-MSC-18969-1] N84-22605
Space station architecture, module, berthing hub, shell assembly, berthing mechanism and utility connection channel
[NASA-CASE-ARC-11505-1] N84-22612

SPACECRAFT ELECTRONIC EQUIPMENT
Space station architecture, module, berthing hub, shell assembly, berthing mechanism and utility connection channel
[NASA-CASE-ARC-11505-1] N84-22612

SPACECRAFT INSTRUMENTS
A new satellite instrument for yaw and pitch measurements
[AD-A138729] N84-22599

SPACECRAFT LAUNCHING
Performance assessment of planetary missions as launched from an orbiting space station
[NASA-CR-173496] N84-22594

SPACECRAFT MANEUVERS
Optimal maneuvers of orbital transfer vehicles N84-22606

SPACECRAFT POWER SUPPLIES
A review of in situ propellant production techniques for solar system exploration
[NASA-CR-173494] N84-22595
Advances in solid state switchgear technology for large space power systems
[NASA-TM-83652] N84-22891
Study of solar array switching power management technology for space power system
[NASA-CR-167890] N84-23021

Study of flywheel energy storage for space stations [NASA-CR-171780] N84-23028

SPACECRAFT PROPULSION
A review of in situ propellant production techniques for solar system exploration [NASA-CR-173494] N84-22595

SPACECRAFT RADIATORS
Radiative cooler — spacecraft radiators [NASA-CASE-NPO-15465-1] N84-22903

SPACECRAFT SHIELDING
Post-test data report for the space shuttle full-scale AFRSI sequence of environments test (OS-305-1 to -5) in the NASA/Ames Research Center 11x11-foot wind tunnel [NASA-CR-167684] N84-22603

SPACING
Ring spacing of Mercurian multi-ring basins and basin ring formation N84-23464

SPALLING
Diamondlike flakes [NASA-CASE-LEW-13837-2] N84-22696

SPARE PARTS
Increasing spares competition in AFLC (Air Force Logistics Center) [AD-P002775] N84-23322
Reshaping the philosophy of spare parts acquisition: Project PACER PRICE [AD-P002791] N84-23338
Central Demand Data Base (CDDB) End Item Code (EIC) [AD-P002807] N84-23353
Improved management of support resources [AD-P002808] N84-23354
Mortality and spareparts: A conceptual analysis [AD-P002826] N84-23371

SPARK MACHINING
Multi-small hole drilling by EDM — electrodischarge machining (EDM) [PNR-90184] N84-22813

SPATIAL DISTRIBUTION
Ultraviolet OH emissions in H2-air diffusion flames N84-22629
Temporal and spatial distribution of exhumed topography N84-23517

SPATIAL FILTERING
Enhancement of spread-spectrum systems through adaptive antenna techniques N84-22824

SPATIAL RESOLUTION
Registration of TM data to digital elevation models N84-22999

SPECTRAL BANDS
LANDSAT 4 band 6 data evaluation [E84-10119] N84-23009

SPECTRAL REFLECTANCE
Atmospheric model development N84-22998
Spectroradiometric calibration of the Thematic Mapper and multispectral scanner system [E84-10098] N84-23000
Sensor radiance for a midlatitude atmospheric model N84-23001
In-flight absolute radiometric calibration of the Thematic Mapper — White Sands, New Mexico N84-23002

SPECTRAL RESOLUTION
Deep level impurities in germanium and silicon: Low temperature passivation or removal techniques [DE84-006772] N84-23286

SPECTRAL SIGNATURES
LANDSAT 4 investigations of Thematic Mapper and multispectral scanner applications — Death Valley, California; Silver Bell Copper Mine, Arizona, and Dulles Airport near Washington, D.C. [E84-10100] N84-23003

SPECTROMETERS
An absolute calibration method for electron cyclotron emission spectrometers [REPT-83-149] N84-22941

SPECTROPHOTOMETRY
Boron in the marine atmosphere N84-23038
Time-resolved spectrophotometry of the nova-like cataclysmic variables RW trianguium and UX Ursa Majoris N84-23408

SPECTROSCOPY
Advanced diagnostics for reacting flows N84-22637
Research into the thermal decomposition of selected energetic material candidates (Project order ATL-2-094) [AD-A138730] N84-22770

SPECTRUM ANALYSIS
Kerma factors for use in 37-group neutron spectrum calculations [AD-A139033] N84-23240
Shock waves and mass outflow in the Orion molecular cloud: Observations of far-infrared emission lines of carbon monoxide, hydroxyl and ammonia N84-23423
MM-wavelength measurements of CO in the atmosphere of Mars and SO2 in the atmosphere of Venus N84-23429
Recent comet impacts on the moon: The evidence from spectral reflectance studies N84-23453
Venus: Global distribution of Pioneer-Venus radar roughness and reflectivity and global correlation of altimetry, roughness and reflectivity observations N84-23461
A case for olivine on Mars N84-23520

SPEECH RECOGNITION
Preliminary analysis of automatic speech recognition and synthesis technology [AD-A138976] N84-22877

SPEED CONTROL
System for torque control of unbalanced rotor during passage through resonance N84-22602

SPHERICAL COORDINATES
Central burst of simultaneously rotating and gravitating body N84-22783

SPHERICAL SHELLS
Estimation of local stress intensity in flanged thin-wall shell structures under heavy thermal load N84-22799
Stressed-strained state of flanged shells under heavy thermal load beyond elastic limit N84-22800
Automatic elimination of static unbalance of rotor in anisotropic bearings N84-22803
Solutions of the Navier-Stokes equations for stationary flow in a spherical gap [PREPRINT-611] N84-22925

SPIN DYNAMICS
Generation of vehicle wobbling by the unsteady flow field in a spinning solid propellant rocket motor N84-22648

SPIN STABILIZATION
Generation of vehicle wobbling by the unsteady flow field in a spinning solid propellant rocket motor N84-22648

SPLINE FUNCTIONS
A computer program for the evaluation of cubic splines [BAE-BT-11729] N84-23131

SPLITTING
La Recherche Aerospatiale, Bimonthly bulletin, number 1983-4, 215/July-August [ESA-TT-823] N84-22589

SPREAD SPECTRUM TRANSMISSION
Navigation system and method [NASA-CASE-GSC-12508-1] N84-22546
Research Trends in Military Communications [AD-A138229] N84-22821
Enhancement of spread-spectrum systems through adaptive antenna techniques N84-22824
Adaptive array combined with spread spectrum in communications N84-22825
Spread spectrum communication in jamming N84-22827
Applications of coding to spread spectrum communications N84-22829
Trends in convolutional coding N84-22830
Spread spectrum networks N84-22831
Spread spectrum data networks N84-22832
Generalized adaptive node concept N84-22833
A digital adaptive array processing algorithm for communications N84-22834
Target super-resolution compensation for coherent airborne radar utilizing spread spectrum waveforms [AD-A138545] N84-22866

SPRINGS (ELASTIC)
State space method for optimal design of shock absorbers with floating boundaries N84-22966

SPUTTERING
Diamondlike flake composites [NASA-CASE-LEW-13837-1] N84-22695
Method of making an ion beam sputter-etched ventricular catheter for hydrocephalus shunt [NASA-CASE-LEW-13107-2] N84-23095

SQUEEZE FILMS
Dual clearance squeeze film damper [NASA-CASE-LEW-13506-1] N84-22562

STABILITY
Effect of hydromechanical inertia forces on stability of cylindrical hydrodynamic bearing N84-22789
Theoretical predictions for the phase stability of dense binary mixtures N84-23428

STABILIZATION
Approach to solving problem of acoustic wave diffraction by elastic shell N84-22804
Balancing of flexible rotors with simultaneous precise determination of influencing factors N84-22808

STAGE SEPARATION
Tanker orbit transfer vehicle and method [NASA-CASE-MSC-20543-1] N84-22610

STAINLESS STEELS
Weld penetration variations [DE84-007915] N84-22963

STANDARDIZATION
Rationalization, standardization and interoperability: Protecting US intersets in the process [AD-P002814] N84-23360

STANDARDS
Monitoring software development through dynamic variables N84-23139
Cost accounting standards: A time for government and industry action [AD-P002767] N84-23314
The new MIL-STDs (Military standard) 1388 [AD-P002806] N84-23352
The avionics integrity program (AVIP) [AD-P002817] N84-23362
Landmarks of progress N84-23397

STAR CLUSTERS
Activities report of the Institute of Astronomy N84-23422
Dynamics and evolution of cD galaxies N84-23425

STAR TRACKERS
Programmable scan/read circuitry for charge coupled device imaging detectors — spacecraft attitude control and star trackers [NASA-CASE-NPO-15345-1] N84-23247
Documentation for the machine-readable version of the catalogue of 20457 Star positions obtained by photography in the declination zone -48 deg to -54 deg (1950) [NASA-TM-85572] N84-23416

STARS
A survey of halo RR Lyrae stars N84-23409
Documentation for the machine-readable version of a supplement to the Bright Star catalogue (Hoffleit, Saladyga and Wlasuk 1983) [NASA-TM-85573] N84-23415
Documentation for the machine-readable version of the general catalogue of 33342 stars for the epoch 1950 (Boss 1937) [NASA-TM-85568] N84-23420
Activities report of the Institute of Astronomy N84-23422

STARSPOTS
H alpha and TiO band observations of RS CVn stars N84-23410

STATIC DEFORMATION
Solving statics problems of thick-walled cylindrical shells with loose contact between layers N84-22805

STATIC FIRING
Computerized static firing analysis techniques of solid propellant rocket motors N84-22641

STATIC PRESSURE
Improvement of dynamic characteristics of gas-static bearings N84-22775

STATICS
Effect of pressure on the static and dynamic acoustic properties of porous rubber [AD-A138744] N84-22756

STATISTICAL ANALYSIS
Civil turbofan propulsion system integration studies using powered testing techniques at ARA, Bedford [ARA-MEMO-248] N84-22581
Measuring roughness of ultrasmooth surfaces by reflectometric method N84-22807
Development of a 3-D microscale topography system [AD-A138809] N84-23013
The planet crossing asteroid survey: Progress in the analysis of populations and terrestrial-planet cratering rates N84-23449
Venus: Global distribution of Pioneer-Venus radar roughness and reflectivity and global correlation of altimetry, roughness and reflectivity observations N84-23461

STATISTICAL DISTRIBUTIONS
Some analytical aspects of the peakedness concept [MC-BW-183/83] N84-23217
Distribution and properties of small volcanoes in Acidalia Planitia N84-23478

STATISTICAL MECHANICS
An exactly solvable model for ideally polarizable interfaces [AD-A138719] N84-23182

STATISTICAL TESTS
Variable selection in heteroscedastic discriminant analysis [CSIR-TWISK-283] N84-23171

STATISTICS
Statistics and operations research in Europe--1983 [AD-A138953] N84-23215

STATOR BLADES
Redesign and cascade tests of a supercritical controlled diffusion stator blade-section [NASA-TM-83635] N84-22533

STEADY FLOW
Transonic flow calculations using triangular finite elements N84-22529

Solutions of the Navier-Stokes equations for stationary flow in a spherical gap
[PREPRINT-611] N84-22925

STEADY STATE
Microcomputer numerical analysis system for gas dynamics application
[NASA-CR-171005] N84-22908

STEELS
The heat treatment response of thermomechanically processed M-50 steel
[AD-A138571] N84-22736
Corrosion control through a better understanding of the metallic substrate/organic coating/interface
[AD-A139086] N84-22739
Measurements of elastohydrodynamic film thickness, wear and tempering behavior of high pressure oxygen turbopump bearings
[NASA-CR-171006] N84-22980
Thermodynamics and kinetics of the gas phase and pack aluminide coating formation on iron and steel N84-23291

STEERABLE ANTENNAS
Reactively steered adaptive array (Resaa) N84-22826

STEERING
Reactively steered adaptive array (Resaa) N84-22826

STELLAR ACTIVITY
H alpha and TiO band observations of RS CVn stars N84-23410

STELLAR ATMOSPHERES
Dynamical relaxation in stellar systems N84-23426
Cometary nucleus and active regions N84-23450
A generalized behavioral model for rotating short period comets with spectral orbital elements and axial orientation N84-23451
Properties of simulated comet mantle N84-23452

STELLAR EVOLUTION
Dynamical relaxation in stellar systems N84-23426
Physics and chemistry in the primitive solar nebula
[MPE-PREPRINT-21] N84-23547

STELLAR MAGNITUDE
Documentation for the machine-readable version of the Survey of the Astrographic Catalogue From 1 to 31 Degrees of Northern Declination (Fresneau 1983)
[NASA-TM-85569] N84-23421

STELLAR MODELS
Dynamical relaxation in stellar systems N84-23426
A generalized behavioral model for rotating short period comets with spectral orbital elements and axial orientation N84-23451

STELLAR ROTATION
Cometary nucleus and active regions N84-23450
A generalized behavioral model for rotating short period comets with spectral orbital elements and axial orientation N84-23451

STELLAR SPECTRA
H alpha and TiO band observations of RS CVn stars N84-23410

STELLAR STRUCTURE
A generalized behavioral model for rotating short period comets with spectral orbital elements and axial orientation N84-23451

STELLAR TEMPERATURE
A generalized behavioral model for rotating short period comets with spectral orbital elements and axial orientation N84-23451

STEREOPHOTOGRAPHY
Volcanism in the Valles Marineris N84-23480

STEREOTELEVISION
Preliminary experience with a stereoscopic video system in a remotely piloted aircraft application
[NASA-TM-84909] N84-22557

STOCHASTIC PROCESSES
Thermodynamic model for a central receiver of a solar plant with partial shading of the heliostat field
[ESA-TT-607] N84-23034
Geometric bounds on the Ornstein-Uhlenbeck velocity process
[CTH-MATH-1983-17] N84-23212
Stochastic dynamical systems with a cyclic structure
[MC-TW-247/83] N84-23214
A framework for the probabilistic analysis of hierarchial planning systems
[MC-BW-180/83] N84-23216

STOCKPILING
Priorities for detailed quality assessments of the National Defense Stockpile nonfuel materials
[NMAB-403] N84-23011

STORAGE
Priorities for detailed quality assessments of the National Defense Stockpile nonfuel materials
[NMAB-403] N84-23011

STORAGE BATTERIES
Chemically rechargeable battery
[NASA-CASE-NPO-16024-1] N84-23020

STORAGE RINGS (PARTICLE ACCELERATORS)
Progress and problems in storage ring free electron lasers
[AD-A136883] N84-22946
Anomalous laser induced bunch lengthening on the ACO storage ring free electron laser
[AD-A136814] N84-22949
UV and VUV degradation of very high reflectivity mirrors for use in a storage ring free electron laser
[AD-A138740] N84-23255
Moving ring reactor KARIN-I
[IPPJ-660] N84-23265

STORMS
Effects of mesoscale weather distrubances on contamination concentrations
[DE84-005753] N84-23036

STORMS (METEOROLOGY)
Forecasting the windstorm of 12 May 1983 (Acension Day) — the Netherlands
[KNMI-TR-43] N84-23079

STRATEGY
Managing program risk: One way to reduce cost growth
[AD-P002754] N84-23301
DECISION TECHNOLOGY: The catalyst for acquisition improvement
[AD-P002755] N84-23302
Designing the equitable risk contract
[AD-P002758] N84-23303
Assumption of risk in the R and D environment
[AD-P002757] N84-23304
An analysis of the acquisition strategy decision process along three dimensions of the acquisition improvement program
[AD-P002758] N84-23305
Skunkworks 81 revisited: An update on acquisition strategy
[AD-P002759] N84-23306

STRATIGRAPHY
Stratigraphic, geochemical, and petrologic studies of the Ammoncosuc volcanics, northcentral Massachusetts and southwestern New Hampshire N84-23059
Cenozoic tectonics of the Caribbean: Structural and stratigraphic studies in Jamaica and Hispaniola N84-23062
Sedimentology and invertebrate paleontology of Triassic and Jurassic Lacustrine deposits, Culpeper Basin, northern Virginia N84-23064
Depositional history and structural evolution of a sedimentary basin in a modern forearc setting, western Sunda Arc, Indonesia N84-23068
Venus banded terrain: Evaluation of tectonic models for the origin of banding N84-23458
Chronology, morphology and stratigraphy of pumiceous pyroclastic-flow (ignimbrite) deposits from the eruption of Mount St. Helens on 18 May 1983 N84-23476
Surface compositions in the Aristarchus Region: Implications for regional stratigraphy N84-23519
Elysium Region, Mars: Characterization of tectonic features N84-23534
Compressional features in the Tharsis Region of Mars: Geographic N84-23536

STRATOSPHERE
Observations of major stratospheric chlorine species
[AD-A138646] N84-23045
Photochemical modeling of the Earth's stratosphere N84-23058

STREAMLINED BODIES
The design and operational development of self-streamlining 2-dimensional flexible walled test sections
[NASA-CR-172326] N84-22534

STREAMS
Freezing of Martian streams under climatic conditions N84-23496

STRESS ANALYSIS
Thermoelastic stresses in metal with temperature: Dependent properties in radiant heating
[BLL-M-35526-(5828.4)] N84-22733
Contact-stress analysis of elastic-viscoelastic interface conditions
[AD-A138834] N84-22759
Estimation of local stress intensity in flanged thin-wall shell structures under heavy thermal load N84-22799
Stressed-strained state of flanged shells under heavy thermal load beyond elastic limit N84-22800
Solving statics problems of thick-walled cylindrical shells with loose contact between layers N84-22805
Fracture toughness processes
[DE84-007244] N84-22989
Venus banded terrain: Evaluation of tectonic models for the origin of banding N84-23458

STRESS CONCENTRATION
Bellows flow-induced vibrations
[NASA-TM-82556] N84-22912

STRESS CORROSION
Corrosion and load transfer effects on fatigue of mechanically fastened joints. Fatigue of zero load transfer specimen
[AD-A139042] N84-22985

STRESS CORROSION CRACKING
On the limiting electrode potential in cavities and its role in deciding between SCC (Stress Corrosion Cracking) and HC (Hydrogen Cracking) in metals
[AD-A138585] N84-22713
Clarification of environmental effects in stress corrosion cracking
[AD-A138581] N84-22737

STRESS INTENSITY FACTORS
An evaluation of algorithms for extracting stress intensity factors from photoelastic data for 3 dimensional problems N84-22974
Fracture toughness processes
[DE84-007244] N84-22989

STRESS RELAXATION
Effect of pressure on the mechanical properties of polymers, part 1
[DE84-006311] N84-22785

STRESS-STRAIN RELATIONSHIPS
Matrix-dominated time-dependent deformation and damage of graphite/epoxy composite experimental data under creep and recovery
[AD-A139064] N84-22704
Deformation studies of polymers by Fourier transform infrared spectroscopy N84-22751
Study of large viscoplastic strains in cylindrical shells by method of magnetic-pulse loading N84-22798
New theory for thick, composite-material rings
[AD-A138538] N84-22981

STRESSES
Factors influencing thermomechanical failure of face seals, 3
[AD-A138548] N84-22981

STRUCTURAL ANALYSIS
Crack layer theory
[NASA-CR-174834] N84-22980
New theory for thick, composite-material rings
[AD-A138538] N84-22981
CASE (Computer-Aided Structural Engineering) study of 6 major general-purpose finite element programs
[AD-A139065] N84-22986
Properties of simulated comet mantle N84-23452
Interpretation of planetary stress systems: Determination of tectonic over-printing in Northwest Wyoming N84-23540

STRUCTURAL BASINS
Mercury: New identification of ancient multi-ring basins and implications for geologic evolution N84-23483
Ring spacing of Mercurian multi-ring basins and basin ring formation N84-23484
Fluvial drainage systems: Margaritifer Sinus and Agyre (NC, NE) quadrangles, Mars N84-23497
Multiprocess evolution of landforms in the Kharga Region, Egypt: Applications to Mars N84-23511
Inversion of topography in Martian highlands terrains N84-23512

STRUCTURAL DESIGN CRITERIA
Definition of technology development missions for early space stations. Large space structures, phase 2, midterm review
[NASA-CR-171004] N84-22607
Improved compliant hydrodynamic fluid journal bearing
[NASA-CASE-LEW-13670-1] N84-22959
Wind power generation design considerations
[AD-A138841] N84-23029

STRUCTURAL ENGINEERING
Micromechanics of fracture in elastomers
[AD-A138783] N84-22758
New theory for thick, composite-material rings
[AD-A138538] N84-22981

STRUCTURAL PROPERTIES (GEOLOGY)
Application of Magsat lithospheric modeling in South America. Part 1: Processing and interpretation of magnetic and gravity anomaly data
[ES4-10115] N84-23008
Geology and geochronology of the southeast border of the Bitterroot Dome: Implications for the structural evolution of the Mylonitic Carapace N84-23065
Structure of the Brevard Zone and Blue Ridge near Lenoir, North Carolina, with observations on oblique crenulation cleavage and a preliminary theory for irrotational structures in shear zones N84-23067
Depositional history and structural evolution of a sedimentary basin in a modern forearc setting, western Sunda Arc, Indonesia N84-23068
Ridges on basalt flows N84-23484
Desert pavement study at Amboy, California N84-23492

STRUCTURAL STABILITY
Fixity of members embedded in concrete
[AD-A138862] N84-22810

Large deformation behavior of long shallow cylindrical composite panels
[NASA-CR-173286] N84-22975

STRUCTURAL STRAIN
Solving statics problems of thick-walled cylindrical shells with loose contact between layers N84-22805

STRUCTURAL WEIGHT
Work capsule for lightweight hydrostatic machines
[CSIR-RR-581] N84-22905

SUBLIMATION
Properties of simulated comet mantle N84-23452

SUBMARINES
New formulas for HED (Horizontal Electric Dipole), HMD (Horizontal Magnetic Dipole), VED (Vertical Electric Dipole), and VMD (Vertical Magnetic Dipole) subsurface-to-subsurface propagation
[AD-A139030] N84-23187
New formulas that extend Norton's farfield elementary dipole equations to the quasi-nearfield range
[AD-A139057] N84-23188

SUBSONIC FLOW
Ultraviolet OH emissions in H2-air diffusion flames N84-22629

SUBSONIC WIND TUNNELS
An experimental and analytic study of the flow subsonic wind tunnel inlets
[AD-A138665] N84-22540

SUBSTRATES
Corrosion control through a better understanding of the metallic substrate/organic coating/interface
[AD-A139066] N84-22739
Method and apparatus for coating substrates using a laser
[NASA-CASE-LEW-13526-1] N84-22944
Development of high strength braze joints in beryllium
[DE84-007243] N84-22964

SUDDEN STORM COMMENCEMENTS
Forecasting the windstorm of 12 May 1983 (Acension Day) — the Netherlands
[KNMI-TR-43] N84-23079

SULFONES
Ethynyl and substituted ethynyl-terminated polysulfones
[NASA-CASE-LAR-12931-1] N84-22747

SULFUR
The 1950 sulfur flow of Mauna Loa: Considerations for Io N84-23479

SUN
Physics and chemistry in the primitive solar nebula
[MPE-PREPRINT-21] N84-23547

SUPERCONDUCTORS
RF properties of superconducting A-15 compounds
[AD-A139067] N84-23285

SUPERCRITICAL AIRFOILS
Redesign and cascade tests of a supercritical controlled diffusion stator blade-section
[NASA-TM-83635] N84-22533

SUPERCRITICAL PRESSURES
Oil shale extraction using super-critical extraction
[NASA-CASE-NPO-15656-1] N84-23012

SUPERHIGH FREQUENCIES
Study of the 13 GHz signal attenuation due to tropical rains
[CRPE-NT-113] N84-22879
Analysis of propagation conditions at 20 and 30 GHz in Europe
[CRPE-NT-122] N84-22880

SUPERNOVAE
Activities report of the Institute of Astronomy N84-23422

SUPERSONIC COMBUSTION RAMJET ENGINES
Numerical predictions of residence times behind a rearward facing step with transverse injection N84-22687

SUPERSONIC CRUISE AIRCRAFT RESEARCH
Development and analysis of a STOL supersonic cruise fighter concept
[NASA-TM-85777] N84-22553

SUPERSONIC DRAG
Wave drag of elongated astroid bodies at moderate supersonic flight velocities N84-22797

SUPERSONIC FLIGHT
Wave drag of elongated astroid bodies at moderate supersonic flight velocities N84-22797

SUPERSONIC FLOW
Three-dimensional, two-phase supersonic nozzle flows
[AD-A139049] N84-22538
Numerical predictions of residence times behind a rearward facing step with transverse injection N84-22687
Combustion performance of a vitiated air heater for a freejet test facility N84-22691
An analysis of shock coalescence including three-dimensional effects with application to sonic boom extrapolation
[NASA-TP-2214] N84-22906

SUPERSONIC SPEEDS
Exact solution to problem of interaction between wedge moving at supersonic velocity and interface of two gaseous media N84-22790

SUPINE POSITION
Factors affecting human tolerance to sustained acceleration
[AD-A138520] N84-23101

SUPPLYING
Satellite Services Catalog: Tools and equipment
[NASA-TM-85627] N84-22597

SUPPORT SYSTEMS
Satellite Services Catalog: Tools and equipment
[NASA-TM-85627] N84-22597
Program Manager's Support System (PMSS): An update
[AD-P002825] N84-23370

SURFACE ACOUSTIC WAVE DEVICES
The Record of Electrical and Communication Engineering Conversazione Tohoku University, volume 52, no. 4
[ISSN-0385-7719] N84-23228
Surface acoustic wave resonators in layered substrates with large electromechanical coupling coefficient N84-23230

SURFACE CRACKS
A review study of nondestructive test techniques for residual stresses in aircraft transparencies
[AD-A138930] N84-22555

SURFACE DEFECTS
Measuring roughness of ultrasmooth surfaces by reflectometric method N84-22807

SURFACE FINISHING
Infrared optics: Holographic and surface relief devices
[BAE-BT-11393] N84-23249
Role of abrasion in the optical polishing of metals and glass
[DE84-005737] N84-23259
Novolac as stain protective film during optical glass fabrication
[DE84-005735] N84-23260

SURFACE IONIZATION
Design and fabrication of a surface conversion negative ion source and an 80 keV pre-accelerator
[DE84-006753] N84-23269

SURFACE PROPERTIES
Physical and chemical investigations on real catalyst surfaces
[BMFT-FB-T-83-273] N84-22729
Measuring roughness of ultrasmooth surfaces by reflectometric method N84-22807
Asymptotic models for wave scattering from very rough surfaces N84-22883
Qualities of SEP ceramic-ceramic Cerasep composites N84-23225
RF properties of superconducting A-15 compounds
[AD-A139067] N84-23285
Voyager feature-fixed photometry of Iapetus N84-23440
Theoretical aspects of photoclinometric terrain profiling on the Galilean satellites N84-23441
Geology of Dione N84-23444
Morphology of fresh craters on Ganymede and the origin of pedestal craters N84-23466

SURFACE REACTIONS
Cathode degradation and erosion in high pressure arc discharges
[NASA-TM-83638] N84-22631
Modification of the near surface region metastable phases and ion induced reactions
[AD-A138842] N84-22694
X-ray photoelectron and Auger electron spectroscopic study of the CdTe surface resulting from various surface pretreatments: Correlations of photoelectrochemical and capacitance-potential behavior with surface chemical composition
[AD-A138601] N84-22714
Electron-transfer kinetics of redox centers anchored to metal surfaces: Weak- versus strong-overlap reaction pathways
[AD-A139043] N84-22718
Intramolecular electron transfer at metal surfaces. 2: Comparisons of ligand-bridged CR(3) reduction kinetics at silver versus mercury electrodes
[AD-A139047] N84-22720
Utility of surface reaction entropies for examining reactant-solvent interactions at electrochemical interfaces. Ferricinium-ferrocene attached to platinum electrodes
[AD-A139055] N84-22722
Redox thermodynamics of surface-bound reactants. Illustrative behavior of Cobalt(3)/(2) macrobicyclic cage complexes
[AD-A139058] N84-22723
A method for evaluating the surface concentrations of 2 like-charged ions simultaneously adsorbed at an electrode-solution interface
[AD-A139074] N84-22724
Corrosion control through a better understanding of the metallic substrate/organic coating/interface
[AD-A139066] N84-22739
Measurement of melt line penetration and heat flux during arc spot welding
[DE84-002013] N84-22962

SURFACE ROUGHNESS
Measuring roughness of ultrasmooth surfaces by reflectometric method N84-22807
Grit blasting a distributed roughness based on a 30% probability of exceedence
[AD-A138779] N84-22809
Asymptotic models for wave scattering from very rough surfaces N84-22883
Photometry of icy satellites: How important is multiple scattering in diluting shadows? N84-23438
Venus: Global distribution of Pioneer-Venus radar roughness and reflectivity and global correlation of altimetry, roughness and reflectivity observations N84-23461

SURFACE TEMPERATURE
Temperature, concentration, and size measurements in turbulent reactive flows N84-22633
Three-color pyrometer for burning particle temperature measurement N84-22635
CONSERVB: A numerical method to compute soil water content and temperature profiles under a bare surface
[E84-10113] N84-23006
Comparisons of sea-surface temperature obtained from ship and satellite data
[AD-A138257] N84-23067
Modeling Io volcanism: Maximum volcanic temperatures, depths of melting and magma composition N84-23436
Thermal infrared analysis of volcanic surfaces: Mars and Hawaii N84-23524

SURFACE WAVES
A review study of nondestructive test techniques for residual stresses in aircraft transparencies
[AD-A138930] N84-22555

SURVEILLANCE
Decision and display analysis in a simple surveillance problem
[AD-P002886] N84-22847
Distributed estimation in the MIT/LL (Massachusetts Institute of Technology/Lincoln Laboratory) DSN (Distributed Sensor Networks) test-bed
[AD-P002897] N84-22856
A framework for evaluation of surveillance algorithms
[AD-P002901] N84-22859
High angular resolution microwave sensing with large, sparse, random arrays
[AD-A138717] N84-22874

SURVEYS
The planet crossing asteroid survey: Progress in the analysis of populations and terrestrial-planet cratering rates N84-23449

SWEPT WINGS
Excitation of Tollmin-Schlichting waves in boundary layer at vibrating surface of infinite-span sweptback wing N84-22792

SWIRLING
Mixing of swirling flows and behavior of wet flows
[AD-A138697] N84-22915

SWITCHES
Advances in solid state switchgear technology for large space power systems
[NASA-TM-83652] N84-22891

SWITCHING
High voltage-high power components for large space power distribution systems
[NASA-TM-83648] N84-22615

SWITCHING CIRCUITS
Study of solar array switching power management technology for space power system
[NASA-CR-167890] N84-23021

SYNCHRONISM
A model for asynchronous distributed computation
[AD-P002879] N84-22840

SYNCHROTRON RADIATION
UV and VUV degradation of very high reflectivity mirrors for use in a storage ring free electron laser
[AD-A138740] N84-23255

SYNOPTIC METEOROLOGY
The vertical redistribution of a pollutant tracer due to cumulus convection N84-23057
A study of Western North Pacific tropical storms and typhoons that intensify after recurvature
[AD-A138792] N84-23075

SYNTHESIS (CHEMISTRY)
Polyphenylene ethers with imide linking groups
[NASA-CASE-LAR-12980-1] N84-22749

SYNTHETIC APERTURE RADAR
Propagation effects in satellite-based synthetic aperture radars
[AD-A138681] N84-22873
SYSTEM EFFECTIVENESS
The acquisition management information system: Friend or foe?
[AD-P002751] N84-23298
Skunkworks 81 revisited: An update on acquisition strategy
[AD-P002759] N84-23306
Large firm efficiency, concentration, and profitability in defense markets
[AD-P002810] N84-23356
Defense systems acquisition review process: A history and evaluation
[AD-P002822] N84-23367
Improving the effectiveness of award fee contracts for program management support services
[AD-P002827] N84-23372
A survey of contractor productivity measurement practices
[AD-P002831] N84-23376
The Score technique: An analytical approach for assessing the results of manufacturing reviews
[AD-P002838] N84-23383
Technical and economic indicators for industrial technological institutes N84-23392
SYSTEMS ANALYSIS
Proceedings of the 6th MIT/ONR (Massachusetts Institute of Technology/Office of Naval Research) Workshop on C3 (Command, Control, and Communications) Systems
[AD-A138614] N84-22835
The design of information structures: Basic allocation strategies for organizations
[AD-P002909] N84-22861
Current research in the Software Engineering Laboratory (SEL) N84-23138
An approach to software baseline generation N84-23149
Mortality and spareparts: A conceptual analysis
[AD-P002826] N84-23371
SYSTEMS COMPATIBILITY
The representation and synthesis of design specifications for distributed software systems N84-23163
Computer and database location in designing distributed computer systems N84-23399
SYSTEMS ENGINEERING
Software engineering for user interfaces
[AD-A138937] N84-23155
Program Manager's Support System (PMSS): An update
[AD-P002825] N84-23370
SYSTEMS INTEGRATION
Integrated testing and maintenance technologies
[AD-A138587] N84-22528
The representation and synthesis of design specifications for distributed software systems N84-23163
SYSTEMS MANAGEMENT
Program Manager's Support System (PMSS): An update
[AD-P002825] N84-23370
SYSTEMS SIMULATION
Stability and performance deterioration due to modelling errors — plant models
[RR-236] N84-23166
An introduction to adjoint techniques
[BAE-BT-11172] N84-23170

T

TABLES (DATA)
Surface wave propagation over sinusoidally varying topography: Theory and observation
[IOS-159-PT-2] N84-22923
TACTICS
Jam-resistant tactical communications N84-22828
TANGENTS
Tangential mode instability in double-base solid rocket motors: A case study N84-22652
TANKERS
Tanker orbit transfer vehicle and method
[NASA-CASE-MSC-20543-1] N84-22610
TAR SANDS
Alternate fuels combustion research
[AD-A138575] N84-22769
TARGET ACQUISITION
Detection of horizontal bars as a function of length, separation, eccentricity and frequency of temporal modulation: Possible applications to helicopter acquisition
[BAE-BT-11288] N84-23105
Modelling of visual search performance
[BAE-BT-14588] N84-23106
TARGET RECOGNITION
Investigation of non-linear estimation of natural resonances in target identification
[AD-A139027] N84-22878
The effect of haze on an operator's visual field and his target detection performance
[AD-A138330] N84-23099
A potentially powerful method of simple automatic recognition exhibiting scale and orientation independance — image processing
[BAE-BT-11068] N84-23102
Some observations on relative approaches to visual acquisition modelling
[BAE-BT-11241] N84-23104
Incorporation of a PROM spatial light modulator into a system for automatic target recognition and tracking — Pockels Readout Optical Modulator (PROM)
[BAE-BT-12841] N84-23250
TARGETS
A formulation and analysis of combat games
[NASA-TM-85927] N84-22585
Decision and display analysis in a simple surveillance problem
[AD-P002886] N84-22847
Target super-resolution compensation for coherent airborne radar utilizing spread spectrum waveforms
[AD-A138545] N84-22866
TAYLOR INSTABILITY
A novel X-ray backlighting method for Rayleigh-Taylor instability measurements on ablatively driven targets
[AD-A138644] N84-22937
Rayleigh-Taylor instability in the presence of a stratified shear layer
[AD-A138544] N84-23043
TAYLOR SERIES
Method of initial functions for thick shells N84-22996
TECHNOLOGICAL FORECASTING
The accelerating pace of advancing aero engine technology
[PNR-90191] N84-22577
Fuel efficient engines for large transport — aircraft
[PNR-90196] N84-22580
The future for titanium and superalloys — in aircraft engines
[PNR-90175] N84-22742
Bibliography of Soviet Laser Developments, Number 63, January-February 1983
[AD-A138742] N84-22948
Publication in professional journals in science and engineering: A survey of editorial procedures and opinion
[AD-A138913] N84-23385
Use of economic mechanisms in managing scientific and technical progress N84-23389
Beyond the data base: Technology for information resource management
[AD-A138840] N84-23402
TECHNOLOGY ASSESSMENT
Advanced planetary studies
[NASA-CR-173498] N84-22591
Space Station Systems Technology Study. Volume 3: Technology and Advancement Program Plan
[NASA-CR-171016] N84-22613
Space Station Systems Technology Study. Volume 1: Executive summary
[NASA-CR-171014] N84-22614
West Europe report: Science and technology
[JPRS-WST-84-011] N84-23224
USSR report: Science and technology policy
[JPRS-UST-84-004] N84-23387
Technical and economic indicators for industrial technological institutes N84-23392
USSR report: Science and technology policy
[JPRS-UST-84-005] N84-23394
Prerequisites for scientific-technical progress enumerated N84-23395
TECHNOLOGY TRANSFER
West Europe report: Science and technology
[JPRS-WST-84-011] N84-23224
The government relationship to industry in technology transfer and development
[AD-P002772] N84-23319
USSR report: Science and technology policy
[JPRS-UST-84-005] N84-23394
Problems of prompt adoption of new technology discussed N84-23396
TECHNOLOGY UTILIZATION
Industrial and marine engine derivatives: A spin-off from aviation — gas turbine engines
[PNR-90197] N84-22581
West Europe report: Science and technology
[JPRS-WST-84-011] N84-23224
Qualities of SEP ceramic-ceramic Cerasep composites N84-23225
Incentives for new production discussed N84-23388
TECTONICS
New maps of Lakshmi Planum and eastern Aphrodite, Venus N84-23457
Venus banded terrain: Evaluation of tectonic models for the origin of banding N84-23458
Volcanism in the Valles Marineris N84-23480
A tectonic geomorphological classification of the walls of Valles Marineris N84-23518
Elysium Region, Mars: Characterization of tectonic features N84-23534
Ancient volcano-tectonic structures of the Olympus Mons Region, Mars N84-23535
Interpretation of planetary stress systems: Determination of tectonic over-printing in Northwest Wyoming N84-23540
Relationships and tectonics of the Jg-7 quadrangle of Ganymede N84-23542
TELECOMMUNICATION
Proceedings of the 6th MIT/ONR (Massachusetts Institute of Technology/Office of Naval Research) Workshop on C3 (Command, Control, and Communications) Systems
[AD-A138614] N84-22835
TELEMETRY
Stochastic techniques applied to the smoothing treatment of bias and compression of artificial satellite tracking and telemetry data
[INPE-2909-TDL/148] N84-22604
TELEOPERATORS
Human factors in space telepresence
[NASA-CR-173420] N84-23119
TEMPERATE REGIONS
A middle latitude ionospheric model
[CRPE-NT-114] N84-23049
TEMPERATURE
The electron density and temperature in the photoionized background gas (N2) surrounding a laser produced plasma
[AD-A138651] N84-23266
TEMPERATURE CONTROL
Space Station Systems Technology Study. Volume 3: Technology and Advancement Program Plan
[NASA-CR-171016] N84-22613
TEMPERATURE DEPENDENCE
Thermoelastic stresses in metal with temperature: Dependent properties in radiant heating
[BLL-M-35526-(5828.4)] N84-22733
A 37.5-kW point design comparison of the nickel-cadmium battery, bipolar nickel-hydrogen battery, and regenerative hydrogen-oxygen fuel cell energy storage subsystems for low Earth orbit
[NASA-TM-83651] N84-23022
TEMPERATURE DISTRIBUTION
Thermoelastic stresses in metal with temperature: Dependent properties in radiant heating
[BLL-M-35526-(5828.4)] N84-22733
Estimation of local stress intensity in flanged thin-wall shell structures under heavy thermal load N84-22799
TEMPERATURE GRADIENTS
Thermoelastic stresses in metal with temperature: Dependent properties in radiant heating
[BLL-M-35526-(5828.4)] N84-22733
TEMPERATURE MEASUREMENT
Optical gas temperature measurement in gas turbines
[PNR-90174] N84-22572
Three-color pyrometer for burning particle temperature measurement N84-22635
Procedure for wall temperature measurement in a metal vapor laser N84-22777
Infrared temperature measurements in combustion systems
[PNR-00170] N84-22942
TEMPERATURE PROFILES
Condensed phase temperature profiles in deflagrating HMX N84-22657
A statistical evaluation and comparison of VISSR Atmospheric Sounder (VAS) data and corresponding rawinsonde measurements
[NASA-TM-82575] N84-23071
Electron Cyclotron Emission (ECE) measurements on the TORTUR 3 Tokamak
[REPT-83-148] N84-23274
MM-wavelength measurements of CO in the atmosphere of Mars and SO2 in the atmosphere of Venus N84-23429
The structure of the Ionian lithosphere N84-23435
TEMPORAL DISTRIBUTION
Temporal and spatial distribution of exhumed topography N84-23517
TENSILE PROPERTIES
Hydrolytic degradation of kapton film
[AD-A139016] N84-22762

TENSILE STRENGTH
Revision of design values for 7075-T7351 and 7075-T7651 aluminum plate
[AD-A139092] N84-22740
TERMINOLOGY
Glossary of Software Engineering Laboratory terms
[NASA-TM-85606] N84-23135
TERRAIN
Registration of TM data to digital elevation models N84-22999
WINDCOM: Estimating surface winds in mountainous terrain
[PB84-157700] N84-23083
Curvilinear ground on Mars: The search for terrestrial analogs N84-23508
Inversion of topography in Martian highlands terrains N84-23512
TERRAIN ANALYSIS
Venus banded terrain: Evaluation of tectonic models for the origin of banding N84-23458
Geology of Maxwell Montes, Venus N84-23460
Venus: Global distribution of Pioneer-Venus radar roughness and reflectivity and global correlation of altimetry, roughness and reflectivity observations N84-23461
Mercury: New identification of ancient multi-ring basins and implications for geologic evolution N84-23463
Radar backscatter modelling N84-23525
Pinacate-Gran Desierto Region, Mexico: SIR-A data analysis N84-23526
Radar-visible wind streaks in the Altiplano of Bolivia N84-23527
The case for aeolian control of meter-scale surface texture on Mars N84-23528
Hypsometric studies of Mars. N84-23530
TEST FACILITIES
Electro-Magnetic Compatability Test Facility, Bristol
[BAE-BT-10658] N84-22586
Combustion performance of a vitiated air heater for a freejet test facility N84-22691
Flow measurement facilities at NEL on 1 August 1983
[NEL-686] N84-22924
TEST STANDS
Apparatus for certification of angular-displacement transducers N84-22806
TETHERED SATELLITES
Dynamics analysis of electrodynamic satellite tethers. Equations of motion and numerical solution algorithms for the tether
[NASA-CR-171777] N84-22598
TETHERING
Dynamics analysis of electrodynamic satellite tethers. Equations of motion and numerical solution algorithms for the tether
[NASA-CR-171777] N84-22598
TETHERLINES
Dynamics analysis of electrodynamic satellite tethers. Equations of motion and numerical solution algorithms for the tether
[NASA-CR-171777] N84-22598
TEXTBOOKS
Educational aids in aircraft combat survivability
[AD-A139090] N84-22556
Landmarks of progress N84-23397
TEXTILES
Preliminary results of the effects of sewing, packing and parachute deployment on material strength
[DE84-006464] N84-22541
THEMATIC MAPPING
LANDSAT-D investigations in snow hydrology
[E84-10094] N84-22997
Atmospheric model development N84-22998
The Pennsylvania defoliation application pilot test
[E84-10111] N84-23004
THERMAL ANALYSIS
Kinetics of the Beta + Delta phase transformation of HMX N84-22681
Hybrid perturbation/Bubnov-Galerkin technique for nonlinear thermal analysis
[NASA-TP-2145] N84-22907
THERMAL CONDUCTIVITY
Characterization of humidity sensors and physical properties of h20
[AD-A139024] N84-22938
THERMAL CONTROL COATINGS
Optimization of thermal systems with sensitive optics, electronics, and structures
[NASA-CR-3745] N84-22608
THERMAL CYCLING TESTS
Thermal endurance of silicone/glass sleeving by the cyclic electrical proof test method of IEC 216 (first report)
[ERA-82-91] N84-22967
Thermal endurance of silicone/glass sleeving by the cyclic electrical proof test method of ICC 216 (second report)
[ERA-82-136] N84-22968
THERMAL DECOMPOSITION
Deuterium isotope effects in HMX thermochemical mechanisms: Decomposition, deflagration, and combustion N84-22680
CARS studies of nitramine LOVA propellant combustion N84-22683
THERMAL DEGRADATION
Research into the thermal decomposition of selected energetic material candidates (Project order ATL-2-094)
[AD-A138730] N84-22770
THERMAL DIFFUSIVITY
Options for an ignited tokamak
[DE84-007927] N84-23272
THERMAL INSTABILITY
Factors influencing thermomechanical failure of face seals, 3
[AD-A138546] N84-22961
THERMAL INSULATION
Post-test data report for the space shuttle full-scale AFRSI sequence of environments test (OS-305-1 to -5) in the NASA/Ames Research Center 11x11-foot wind tunnel
[NASA-CR-167684] N84-22603
THERMAL MAPPING
New maps of Lakshmi Planum and eastern Aphrodite, Venus N84-23457
Thermal infrared analysis of volcanic surfaces: Mars and Hawaii N84-23524
THERMAL NEUTRONS
Kerma factors for use in 37-group neutron spectrum calculations
[AD-A139033] N84-23240
THERMAL NOISE
La Recherche Aerospatiale, Bimonthly bulletin, number 1983-4, 215/July-August
[ESA-TT-823] N84-22580
THERMAL PROTECTION
Pre-stressed thermal protection systems
[NASA-CASE-MSC-20254-1] N84-22601
THERMAL RESISTANCE
Fire and heat resistant laminating resins based on maleimido substituted aromatic cyclotriphosphazenes
[NASA-CASE-ARC-11428-1] N84-22697
Heat resistant protective hand covering
[NASA-CASE-MSC-20261-2] N84-23113
THERMAL STABILITY
The onset of detonation behind incident shock waves in chlorine azide-argon mixtures N84-22921
Thermal endurance of silicone/glass sleeving by the cyclic electrical proof test method of IEC 216 (first report)
[ERA-82-91] N84-22967
Thermal endurance of silicone/glass sleeving by the cyclic electrical proof test method of ICC 216 (second report)
[ERA-82-136] N84-22968
THERMAL STRESSES
Estimation of local stress intensity in flanged thin-wall shell structures under heavy thermal load N84-22799
Stressed-strained state of flanged shells under heavy thermal load beyond elastic limit N84-22800
THERMOCHEMICAL PROPERTIES
Computerized static firing analysis techniques of solid propellant rocket motors N84-22641
THERMOCHEMISTRY
Deuterium isotope effects in HMX thermochemical mechanisms: Decomposition, deflagration, and combustion N84-22680
Modeling the self-deflagration of HMX N84-22682
Combustion thermodynamics of some boron-nitrogen-hydrogen compounds N84-22684
THERMOCLINES
The effect of interior motion on seasonal thermocline evolution
[AD-A138270] N84-23088
THERMODYNAMIC COUPLING
Redox thermodynamics of surface-bound reactants. Illustrative behavior of Cobalt(3)/(2) macrobicyclic cage complexes
[AD-A139058] N84-22723
THERMODYNAMIC CYCLES
Stressed-strained state of flanged shells under heavy thermal load beyond elastic limit N84-22800
THERMODYNAMIC PROPERTIES
Effect of non-constant solid phase thermal properties on temperature sensitivity of solid propellant N84-22654
Electron-transfer kinetics of redox centers anchored to metal surfaces: Weak- versus strong-overlap reaction pathways
[AD-A139043] N84-22718
Hypersonic flow around flat body in case of intense radiative heat exchange N84-22795
Qualities of SEP ceramic-ceramic Cerasep composites N84-23225
THERMODYNAMICS
The thermodynamics of real and unreal black powder N84-22675
Thermoelastic stresses in metal with temperature: Dependent properties in radiant heating
[BLL-M-35526-(5828.4)] N84-22733
The calculation of the heat transfer associated with the injection of methane gas at the stagnation point of the dissociated boundary layer of the laminar air flow
[AD-A139063] N84-22918
Crack layer theory
[NASA-CR-174634] N84-22980
Thermodynamic model for a central receiver of a solar plant with partial shading of the heliostat field
[ESA-TT-807] N84-23034
The ideally polarizable interface: A solvable model and general sum rules
[AD-A138720] N84-23207
An experimental estimate of the electron-tunneling distance for some outer-sphere electrochemical reactions
[AD-A139049] N84-23284
Thermodynamics and kinetics of the gas phase and pack aluminide coating formation on iron and steel N84-23291
Geologic investigations of outer planets satellites
[NASA-CR-173497] N84-23544
THERMOELASTICITY
Thermoelastic stresses in metal with temperature: Dependent properties in radiant heating
[BLL-M-35526-(5828.4)] N84-22733
Factors influencing thermomechanical failure of face seals, 3
[AD-A138546] N84-22961
THERMOMECHANICAL TREATMENT
Select fiber composites for space applications: A mechanistic assessment
[NASA-TM-83631] N84-22702
The heat treatment response of thermomechanically processed M-50 steel
[AD-A138571] N84-22736
THERMONUCLEAR REACTIONS
Television system for monitoring target position in laser thermonuclear fusion experiments N84-22781
THERMOPLASTIC RESINS
Ethynyl and substituted ethynyl-terminated polysulfones
[NASA-CASE-LAR-12931-1] N84-22747
THERMOPLASTICITY
Thermoset-thermoplastic aromatic polyamide containing N-propargyl groups
[NASA-CASE-LAR-12723-2] N84-22746
THESAURI
NASA Thesaurus supplement. Part 1: Hierarchical listing
[NASA-SP-7051(SUPPL-1)] N84-23398
THICK WALLS
Solving statics problems of thick-walled cylindrical shells with loose contact between layers N84-22805
THICKNESS
New theory for thick, composite-material rings
[AD-A138538] N84-22981
Morphology of buried craters: Lava thickness estimates by simulated flooding N84-23471
THIN FILMS
Ferroelectric tungsten bronze bulk crystals and epitaxial thin films for electro-optic device applications
[AD-A138693] N84-23278
THIN PLATES
A discrete-element analysis for large deflection of thin plates: A combined effect of geometric and material nonlinearities N84-22995
THIN WALLED SHELLS
Stressed-strained state of flanged shells under heavy thermal load beyond elastic limit N84-22800
THREE DIMENSIONAL BOUNDARY LAYER
Excitation of Tollmin-Schlichting waves in boundary layer at vibrating surface of infinite-span sweptback wing N84-22792
THREE DIMENSIONAL FLOW
Three-dimensional nonequilibrium viscous shock-layer flow over the Space Shuttle orbiter N84-22530
Three-dimensional, two-phase supersonic nozzle flows
[AD-A138649] N84-22538
An experimental and analytic study of the flow subsonic wind tunnel inlets
[AD-A138865] N84-22540
Aircraft exhaust plume signature predictions for non-axisymmetric multiple engine installations N84-22627

Three-dimensional vorticity procedure interactions in combustion instability analysis of solid propellant rocket motors N84-22647
Discharge of ideal gas into vacuum N84-22785
Theory of hypersonic three-dimensional flow of nonsteady gas stream with relaxation past thin wing with arbitrary aspect ratio N84-22791
Interaction of unsteady spatial boundary layer with hypersonic flow near rapidly heated portion of surface N84-22794
Transient three-dimensional predictions of turbulent flows in cylindrical and cartesian coordinate systems N84-22927

THRUST CHAMBERS
Investigation of combustion characteristics of a high chamber pressure rocket motor N84-22693

TIDES
The Laplacian resonance and tidal dissipation N84-23434

TIME CONSTANT
The effects of widening time constants and increasing time delay on controller design using approximate models
[RR-239] N84-22817

TIME DEPENDENCE
Matrix-dominated time-dependent deformation and damage of graphite/epoxy composite experimental data under creep and recovery
[AD-A139064] N84-22704
Finite element analysis of structure subjected to nonstationary load fields with contact interfaces N84-22993
Transient processes in an inductor system consisting of a flat coil and a multilayer conducting medium
[AD-A139053] N84-23232

TIME LAG
Robustness and sensitivity of Smith predictor controllers for time-delay systems
[RR-238] N84-22812
The effects of widening time constants and increasing time delay on controller design using approximate models
[RR-239] N84-22817
Multi-sensor array time-delay estimation with small phase incoherences
[AD-A138867] N84-23183
Local bifurcation of a logistic delay map
[MC-TW-246/83] N84-23205
The queue G/G/lc Finite moments of the cycle variables and uniform rates of convergence
[CTH-MATH-1983-24] N84-23218

TIME MEASUREMENT
Age and evolution of the Yukon-Tanana Terrane, southeastern Yukon Territory N84-23060

TITAN
Titan exploration with advanced systems. A study of future mission concepts
[NASA-CR-173499] N84-22593

TITANIUM
Method and apparatus for coating substrates using a laser
[NASA-CASE-LEW-13526-1] N84-22944

TITANIUM ALLOYS
The future for titanium and superalloys — in aircraft engines
[PNR-90175] N84-22742
Method and apparatus for coating substrates using a laser
[NASA-CASE-LEW-13526-1] N84-22944

TITANIUM OXIDES
H alpha and TiO band observations of RS CVn stars N84-23410

TOKAMAK DEVICES
A classical picture of anomalous effects in a Tokamak
[IPPJ-664] N84-23263
Magnetic fusion energy research and development
[DE84-007089] N84-23270
Options for an ignited tokamak
[DE84-007927] N84-23272
Electron Cyclotron Emission (ECE) measurements on the TORTUR 3 Tokamak
[REPT-83-148] N84-23274

TOLLMEIN-SCHLICHTING WAVES
Excitation of Tollmin-Schlichting waves in boundary layer at vibrating surface of infinite-span sweptback wing N84-22792

TOPEX
Topex: Observing the oceans from Space
[NASA-CR-173490] N84-23085

TOPOGRAPHY
Development of a 3-D microscale topography system
[AD-A138809] N84-23013
Scientific activity in oceanography, 1979-1982 N84-23084
Reports of planetary geology program, 1983
[NASA-TM-86246] N84-23431
Theoretical aspects of photoclinometric terrain profiling on the Galilean satellites N84-23441
Topography on Ganymede derived from photoclinometry N84-23442
New models for landform evolution on Io N84-23443
Geology of Dione N84-23444
New maps of Lakshmi Planum and eastern Aphrodite, Venus N84-23457
Geology of Maxwell Montes, Venus N84-23460
Venus: Global distribution of Pioneer-Venus radar roughness and reflectivity and global correlation of altimetry, roughness and reflectivity observations N84-23461
Mercury: New identification of ancient multi-ring basins and implications for geologic evolution N84-23463
Differential degradation of Martian impact basins N84-23468
Progressive impact cratering N84-23469
Geomorphic clues to the Martian volatile inventory. 1: Flow ejecta blankets N84-23474
Dark streaks on talus slopes, Mars N84-23499
Inversion of topography in Martian highlands terrains N84-23512
Temporal and spatial distribution of exhumed topography N84-23517
Rapid extraction of relative topography from Viking orbiter images. 2: Application to irregular topographic features N84-23523
Hypsometric studies of Mars. N84-23530
Correction and geological analysis of lunar 3.8 CM radar data N84-23531
Mapping and geological analysis of Mercury radar data N84-23532
Mercury: Topographic and geologic data from Earth-based radar observations N84-23533

TOPOLOGY
The equicontinuous structure relation and extension of functions defined on G-spaces
[MC-ZW-192/83] N84-23194

TORQUE
System for torque control of unbalanced rotor during passage through resonance N84-22802

TORSIONAL STRESS
System for torque control of unbalanced rotor during passage through resonance N84-22802

TORSIONAL VIBRATION
System for torque control of unbalanced rotor during passage through resonance N84-22802

TOXICITY
Modeling of inhalation administration of vapors with capacity limited clearance
[AD-A138847] N84-23098

TRACKING (POSITION)
Frequency encoded auditory display of the critical tracking task
[NASA-TM-85869] N84-22558
Stochastic techniques applied to the smoothing treatment of bias and compression of artificial satellite tracking and telemetry data
[INPE-2909-TDL/148] N84-22604
A unified approach to modeling and combining of evidence through random set theory
[AD-P002880] N84-22841
Distributed estimation in the MIT/LL (Massachusetts Institute of Technology/Lincoln Laboratory) DSN (Distributed Sensor Networks) test-bed
[AD-P002897] N84-22856
Optimal maneuver detection and estimation in multiobject tracking
[AD-P002899] N84-22858
The use of reciprocal polar co-ordinates in passive tracking
[AD-P002906] N84-22860
Manufacturing cost analysis for photovoltaic concentrator tracking structures
[DE84-006318] N84-23032
Disturbance minimization techniques for linear, time-invariant dynamical systems
[AD-A138915] N84-23185
On a simple adaptive tracking filter
[AD-A138955] N84-23186
Documentation for the machine-readable version of the catalogue of 20457 Star positions obtained by photography in the declination zone -48 deg to -54 deg (1950)
[NASA-TM-85572] N84-23416

TRACKING NETWORKS
Multiple access adaptive antennas N84-22823

TRAFFIC
Empirical analysis of a token ring network
[AD-A138905] N84-23164

TRAINING DEVICES
Educational aids in aircraft combat survivability
[AD-A139090] N84-22556
Device 2E6 (ACMS) Air Combat Maneuvering Simulator instructor console review
[AD-A138972] N84-22587
Skunkworks 81 revisited: An update on acquisition strategy
[AD-P002759] N84-23306

TRAJECTORIES
The planet crossing asteroid survey: Progress in the analysis of populations and terrestrial-planet cratering rates N84-23449

TRAJECTORY CONTROL
Adaptive control strategies for computer-controlled manipulators N84-23114

TRANSDUCERS
Acoustic and photoelectric burnout detection of T-burner grains N84-22660

TRANSFER FUNCTIONS
Analysis of the transfer function model of tray-type binary distillation columns with liquid hydraulic delay
[RR-234] N84-22816
Model reference adaptive control systems: The hybrid approach N84-23169

TRANSFORMATIONS (MATHEMATICS)
Time optimal digital control of multi-unit paper web dynamics N84-22991

TRANSFORMERS
Development of high frequency low weight power magnetics for aerospace power systems
[NASA-TM-83656] N84-22692

TRANSITION
A summary of the mechanisms of delayed detonation N84-22658

TRANSITION METALS
Observation of surface-enhanced Raman scattering for transition-metal hexaammine cations at the outer Helmholtz plane: Implications for enhancement mechanisms at electrochemical interfaces
[AD-A139045] N84-22719
Organometallic chemistry of weakly solvated transition metal cations
[DE84-006987] N84-22726

TRANSITION TEMPERATURE
Kinetics of the Beta + Delta phase transformation of HMX N84-22661
Infrared temperature measurements in combustion systems
[PNR-90170] N84-22942

TRANSMITTANCE
Atmospheric correction study/atmospheric model optimization
[INPE-2969-RPE/448] N84-23040

TRANSONIC FLOW
Transonic flow calculations using triangular finite elements N84-22529
Redesign and cascade tests of a supercritical controlled diffusion stator blade-section
[NASA-TM-83635] N84-22533
More precise numerical simulation of transonic flow through passages in turbomachines N84-22786
Transonic flow around protruding corner with free streamline N84-22796

TRANSONIC SPEED
Numerical simulation of the tip vortex off a low-aspect-ratio wing at transonic speed
[NASA-TM-85932] N84-22535

TRANSPARENCE
Light transmitting window assembly
[NASA-CASE-MSC-18417-1] N84-23251

TRANSPORT AIRCRAFT
Fuel efficient engines for large transport — aircraft
[PNR-90196] N84-22580

TRANSPORT PROPERTIES
Development of holographic interferometry for welding arc analysis
[DE84-005454] N84-22940

TRANSPORT THEORY
Theoretical influence of the deposition conditions on the uniformity of boron carbide coatings N84-22707
Loeb solutions of the Boltzmann equation
[CTH-MATH-1983-82] N84-22926

TRAVELING WAVES
Wave attenuation in periodic structures
[AD-A138924] N84-22984

TREES (MATHEMATICS)
Ordered address binary trees: A technique for the optimization of access to trees on disk
[INPE-2916-PRE/426] N84-23133

TROPICAL METEOROLOGY
Study of the 13 GHz signal attenuation due to tropical rains
[CRPE-NT-113] N84-22879

TROPICAL STORMS
A study of Western North Pacific tropical storms and typhoons that intensify after recurvature
[AD-A138792] N84-23075

TROPOSPHERE
Kinetic studies of atmospheric reactions of OH radicals N84-23050

TRUNCATION ERRORS
Linear multistep methods with minimized truncation error for periodic initial value problems
[MC-NW-157/83] N84-23195
TUNABLE LASERS
Spectrophone stabilized laser with line center offset frequency control
[NASA-CASE-NPO-15516-1] N84-22943
TUNGSTEN
Ferroelectric tungsten bronze bulk crystals and epitaxial thin films for electro-optic device applications
[AD-A139693] N84-23278
TUNING
Spectrophone stabilized laser with line center offset frequency control
[NASA-CASE-NPO-15516-1] N84-22943
TURBINE BLADES
Film cooling on a gas turbine blade near the end wall
[AD-A138794] N84-22569
Effect of rotation on thermal state of runner blade through effect on heat transfer on coolant side N84-22787
TURBINE ENGINES
Variable stator radial turbine
[NASA-CR-174663] N84-22568
TURBINE PUMPS
Industrial and marine engine derivatives: A spin-off from aviation — gas turbine engines
[PNR-90197] N84-22581
Measurements of elastohydrodynamic film thickness, wear and tempering behavior of high pressure oxygen turbopump bearings
[NASA-CR-171008] N84-22960
TURBINES
Aeronautics and Space Engineering Board: Aeronautics Assessment Committee
[NASA-TM-85594] N84-22771
TURBOFAN ENGINES
Civil turbofan propulsion system integration studies using powered testing techniques at ARA, Bedford
[ARA-MEMO-246] N84-22581
Engine reliability through bearing condition monitoring — aircraft engines
[PNR-90168] N84-22570
Emissions variability and traversing on production RB211 engines
[PNR-90176] N84-22573
Fuel efficient engines for large transport — aircraft
[PNR-90196] N84-22580
The design and development of a low emissions Transply combustor for the civil Spey engine
[PNR-90198] N84-22582
A review of advanced manufacturing technology — gas turbine components
[PNR-90194] N84-22815
Fan noise reduction achieved by removing tip flow irregularities behind the rotor - forward arc test configurations
[NASA-TM-83616] N84-23235
TURBOFANS
The accelerating pace of advancing aero engine technology
[PNR-90191] N84-22577
TURBOGENERATORS
Wind and solar powered turbine
[NASA-CASE-NPO-15496-1] N84-23018
TURBOJET ENGINE CONTROL
Helicopter engine technology with particular reference to the Rolls-Royce Gem engine
[PNR-90193] N84-22578
TURBOMACHINE BLADES
Calculation of apparent masses in blade ring N84-22793
TURBOMACHINERY
Analysis of inviscid and viscous flows in cascades with an explicit multiple-grid algorithm
[NASA-TM-83636] N84-22527
Oxidizing seal for a turbine tip gas path
[NASA-CASE-LEW-14053-1] N84-22563
Determination of compressor in-stall characteristics from engine surge transients
[NASA-TM-83639] N84-22568
More precise numerical simulation of transonic flow through passages in turbomachines N84-22786
Estimation of local stress intensity in flanged thin-wall shell structures under heavy thermal load N84-22799
Stressed-strained state of flanged shells under heavy thermal load beyond elastic limit N84-22800
Method of fabricating an abradable gas path seal
[NASA-CASE-LEW-13269-2] N84-22957
Improved compliant hydrodynamic fluid journal bearing
[NASA-CASE-LEW-13670-1] N84-22959
Wind and solar powered turbine
[NASA-CASE-NPO-15496-1] N84-23018
TURBOPROP ENGINES
Turboprop engine design concepts
[PNR-90181] N84-22576
TURBULENCE
Numerical simulation of the tip vortex off a low-aspect-ratio wing at transonic speed
[NASA-TM-85932] N84-22535
Heterogeneous diffusion flame stabilization: Constant density results N84-22689
TURBULENCE EFFECTS
Correlation between the meteorological parameters and the optical strength of atmospheric turbulence close to the ground. Part 3: Results
[BAE-BT-10771] N84-23070
TURBULENT BOUNDARY LAYER
The changing scene in computational fluid dynamics
[AD-A138661] N84-22914
Theoretical investigation of three-dimensional shock wave-turbulent boundary layer interactions, part 2
[AD-A138722] N84-22916
Aerodynamic sound generation by turbulent boundary layer flow along solid and compliant walls
[MPIS-116/1983] N84-23239
TURBULENT FLOW
Preliminary investigation of a two-zone swirl flow combustor
[NASA-TM-83637] N84-22565
Exhaust plume induced fluctuations in the index of refraction at optical wavelengths N84-22624
On the oscillatory flowfield in solid rocket motors N84-22645
Turbulence modeling
[NASA-TM-85889] N84-22913
Transient three-dimensional predictions of turbulent flows in cylindrical and cartesian coordinate systems N84-22927
TURBULENT HEAT TRANSFER
Heat transfer in serpentine passages with turbulence promoters
[NASA-TM-83614] N84-22911
TURBULENT MIXING
Mach number and density effects in the mixing of supersonic jets N84-22628
TURING MACHINES
An N to the 1.618th power lower bound on the time to simulate one queue or two pushdown stores by one tape
[MC-IW-245/83] N84-23161
The simple roots of real-time computation hierarchies (preliminary version)
[MC-IW-244/83] N84-23203
TURRET
A formulation and analysis of combat games
[NASA-TM-85927] N84-22585
TWO DIMENSIONAL BODIES
The design and operational development of self-streamlining 2-dimensional flexible walled test sections
[NASA-CR-172328] N84-22534
TWO PHASE FLOW
Three-dimensional, two-phase supersonic nozzle flows
[AD-A138649] N84-22538
Detailed flow measurements in fuel-rich, particle-laden plumes N84-22690
Mixing of swirling flows and behavior of wet flows
[AD-A138697] N84-22915

U

U.S.S.R.
USSR report: Engineering and equipment
[JPRS-UEQ-84-004] N84-22772
Scientific activity in hydrology, 1979-1982 N84-23010
Landmarks of progress N84-23397
ULTRAPURE METALS
Deep level impurities in germanium and silicon: Low temperature passivation or removal techniques
[DE84-006772] N84-23286
ULTRASONIC DENSIMETERS
High resolution ultrasonic densitometer
[DE84-003367] N84-22939
ULTRASONIC FLAW DETECTION
Two-dimensional scanner apparatus — flaw detector in small flat plates
[NASA-CASE-MFS-25687-1] N84-22928
Non-destructive evaluation of composite materials using ultrasound
[NASA-CR-173416] N84-22969
Ultrasonic methods to study shadow boundaries of diffracting cracks. Ultrasonic caustics in NDE (Non-Destructive Evaluation)
[AD-A138639] N84-22970
ULTRASONIC TESTS
Compressibility of colloids. 2: Compressibility studies of tri-block non-ionic polymers in toluene and water solutions
[AD-A138738] N84-22755
ULTRASONIC WAVE TRANSDUCERS
Ultrasonic transducer with Gaussian radial pressure distribution
[NASA-CASE-LAR-12967-1] N84-22932
ULTRASONICS
A review study of nondestructive test techniques for residual stresses in aircraft transparencies
[AD-A138930] N84-22555
ULTRAVIOLET RADIATION
Hydrolytic degradation of Kevlar 49 fibers
[DE84-004158] N84-22705
UNDERWATER ACOUSTICS
Undersea sound speed and range estimation
[AD-A138954] N84-23237
UNDERWATER STRUCTURES
Underwater shock-induced responses of submerged cylindrical structures
[AD-A139072] N84-22987
UNIVERSITIES
Training acquisition personnel through a local college
[AD-P002766] N84-23313
UNSTEADY FLOW
Improvement of dynamic characteristics of gas-static bearings N84-22775
Separation flow past bodies with fixed separation sites N84-22784
Theory of hypersonic three-dimensional flow of nonsteady gas stream with relaxation past thin wing with arbitrary aspect ratio N84-22791
Interaction of unsteady spatial boundary layer with hypersonic flow near rapidly heated portion of surface N84-22794
UPWELLING WATER
A one dimensional model for the study of upwelling
[INPE-2936-RPE/445] N84-23086
USER MANUALS (COMPUTER PROGRAMS)
User's manual of a program to compute the distribution of photoelectrons — atmospheric ionization
[CRPE-NT-110] N84-23054
Software Engineering Laboratory (SEL) data base reporting software user's guide and system description. Volume 1: Introduction and user's guide
[NASA-TM-85606] N84-23129
Software Engineering Laboratory (SEL) data base reporting software user's guide and system description. Volume 2: Program descriptions
[NASA-TM-85609] N84-23130
Users guide for ERB 7 MAT (including the first year quality control)
[NASA-CR-170514] N84-23134
Generalized monitoring facility. Users manual. Change 7
[AD-A138533] N84-23151
User manual for driver program
[AD-A139028] N84-23158
USER REQUIREMENTS
Human factors aspects of C3 systems — command, control, communication (C3)
[PP-119] N84-23115
Software engineering for user interfaces
[AD-A138937] N84-23155
Corporate DP planning: New approaches and new concerns — data processing (DP)
[PNR-90180] N84-23388
UTAH
Impact of Upheaval Dome, Utah N84-23485

V

V/STOL AIRCRAFT
V/STOL concepts in the United States: Past, present, and future
[NASA-TM-85938] N84-22532
Assessment of aerodynamic performance of V/STOL and STOVL fighter aircraft
[NASA-TM-85937] N84-22536
V/STOL maneuverability and control
[NASA-TM-85939] N84-22584
VACUUM
Discharge of ideal gas into vacuum N84-22785
VACUUM CHAMBERS
Experience with development of sealed linear waveguide electron accelerators N84-22780
Method for sequentially processing a multi-level interconnect circuit in a vacuum chamber
[NASA-CASE-MFS-256704-1] N84-22884
All-aluminum-alloy UHV chamber for molecular beam epitaxy, 1 N84-23229

VACUUM DEPOSITION
Diamondlike flakes
[NASA-CASE-LEW-13837-2] N84-22696
VALLEYS
A regression model for the temporal development of soil pipes and associated gullies in the alluvial-fill valley of the Rio Puerco, central New Mexico N84-23502
Salts in the dry valleys of Antartica N84-23510
Scarp development in the Valles Marineris N84-23515
Radar-visible wind streaks in the Altiplano of Bolivia N84-23527
VAPOR DEPOSITION
Theoretical influence of the deposition conditions on the uniformity of boron carbide coatings N84-22707
VAPOR PHASE EPITAXY
Production oriented 3-5 epitaxy
[BMFT-FB-T-83-286] N84-23290
VAPOR PHASES
Convective heating of energetic materials N84-22672
Molecular dynamics of propellant gases N84-22674
Nitramine propellant ignition under rapid gas loading conditions N84-22677
Mass spectroscopic investigations of the reactions of O2 (1 deltag) with furan, 2-methylfuran, and 2,5-dimethylfuran in the gas phase
[MPIS-7/1983] N84-22731
Boron in the marine atmosphere N84-23036
Primary patterns of electronically excited molecules in the gas phase 2
[MPIS-9/1983] N84-23245
VAPORS
Modeling of inhalation administration of vapors with capacity limited clearance
[AD-A138847] N84-23098
VARIABILITY
Slotted variable camber flap
[NASA-CASE-LAR-12541-1] N84-22551
Study of variability in extragalactic radio sources at 22 GHz and 44 GHz
[INPE-2913-TDL/149] N84-23549
VARIABLE GEOMETRY STRUCTURES
Variable stator radial turbine
[NASA-CR-174663] N84-22568
VARIABLE STARS
A generalized behavioral model for rotating short period comets with spectral orbital elements and axial orientation N84-23451
VARIATIONAL PRINCIPLES
Calculation procedures for variational, Born and exact solutions for electromagnetic scattering from two randomly separated dielectric Rayleigh cylinders
[AD-A138543] N84-22665
VARIATIONS
Quenchings and outbursts of extragalactic radio sources: Nine years of 3.3-mm measurements and comparisons with centimeter-wave variations
[AD-A136233] N84-23550
VECTOR SPACES
On systems with spectral cluster points and their relation to H sup p spaces
[RR-235] N84-23222
VECTORS (MATHEMATICS)
Transient processes in an inductor system consisting of a flat coil and a multilayer conducting medium
[AD-A139053] N84-23232
VELOCITY COUPLING
Fluid-dynamically coupled solid propellant combustion instability - cold flow simulation N84-22644
On the oscillatory flowfield in solid rocket motors N84-22645
VELOCITY MEASUREMENT
Particle sizing in a fuel rich airbreathing engine combustor N84-22634
Insitu measurement of burning rate N84-22639
VENERA SATELLITES
Venus: The nature of the surface from Venera panoramas N84-23459
VENUS ATMOSPHERE
MM-wavelength measurements of CO in the atmosphere of Mars and SO2 in the atmosphere of Venus N84-23429
Wind abrasion on Venus: A means for experimental investigations N84-23455
Aeolian processes on Venus N84-23456
VENUS SURFACE
Characterization of surficial geologic units on Venus from Pioneer Venus radar data: A progress report N84-23454
Aeolian processes on Venus N84-23456
New maps of Lakshmi Planum and eastern Aphrodite, Venus N84-23457
Venus banded terrain: Evaluation of tectonic models for the origin of banding N84-23458
Venus: The nature of the surface from Venera panoramas N84-23459
Geology of Maxwell Montes, Venus N84-23460
Venus: Global distribution of Pioneer-Venus radar roughness and reflectivity and global correlation of altimetry, roughness and reflectivity observations N84-23461
Velocities of windblown particles in saltation: Venus, Earth, and Mars N84-23491
VERTICAL TAKEOFF AIRCRAFT
Assessment of aerodynamic performance of V/STOL and STOVL fighter aircraft
[NASA-TM-85937] N84-22536
Independent cost estimates: A case study joint vertical lift aircraft (JVX) program
[AD-P002797] N84-23343
VERY HIGH FREQUENCIES
Intermodulation between v.h.f./t.m. broadcast transmitters and the protection of adjacent-band aeronautical services
[BBC-RD-1984/2] N84-22819
VERY LARGE SCALE INTEGRATION
The synthesis and validation of experimental VLSI design using decoupled behavioral, structural and physical specifications N84-22902
VIBRATION
Bellows flow-induced vibrations
[NASA-TM-82556] N84-22912
Wave attenuation in periodic structures
[AD-A138924] N84-22984
Effects of transverse loading on the thickness shear resonance frequencies in crystal plates N84-22994
VIBRATION EFFECTS
Rocket motor aeroacoustics N84-22642
Generation of vehicle wobbling by the unsteady flow field in a spinning solid propellant rocket motor N84-22648
The Shock and Vibration Digest, volume 16, no. 3
[AD-A139707] N84-22976
VIBRATION ISOLATORS
Dual clearance squeeze film damper
[NASA-CASE-LEW-13506-1] N84-22562
VIBRATION SIMULATORS
Certification vibration tests, SD602 materials experiment
[AD-A138547] N84-22982
VIBRATION TESTS
Environmental qualification tests, signal conditioning unit, SD602 materials experiment
[AD-A138910] N84-22897
Certification vibration tests, SD602 materials experiment
[AD-A138547] N84-22982
VIDEO DATA
A high speed processor for binary images
[AD-A138908] N84-23125
VIDEO EQUIPMENT
Preliminary experience with a stereoscopic video system in a remotely piloted aircraft application
[NASA-TM-84909] N84-22557
VIDEO SIGNALS
Programmable scan/read circuitry for charge coupled device imaging detectors — spacecraft attitude control and star trackers
[NASA-CASE-NPO-15345-1] N84-23247
VIKING SPACECRAFT
Distribution and properties of small volcanoes in Acidalia Planitia N84-23478
VIRGINIA
Sedimentology and invertebrate paleontology of Triassic and Jurassic Lacustrine deposits, Culpeper Basin, northern Virginia N84-23064
VISCOELASTICITY
Contact-stress analysis of elastic-viscoelastic interface conditions
[AD-A138834] N84-22759
VISCOPLASTICITY
Study of large viscoplastic strains in cylindrical shells by method of magnetic-pulse loading N84-22798
VISCOUS FLOW
Analysis of inviscid and viscous flows in cascades with an explicit multiple-grid algorithm
[NASA-TM-83636] N84-22527
Three-dimensional nonequilibrium viscous shock-layer flow over the Space Shuttle orbiter N84-22530
Three-dimensional nonequilibrium viscous shock-layer flows over complex reentry vehicles N84-22543
Fluid-dynamically coupled solid propellant combustion instability - cold flow simulation N84-22644
VISIBILITY
AWOS (Automatic Weather Observing System) sensor evaluation. Transmissometer, forward-scatter meter and lidar ceilometer
[AD-A138743] N84-23074
VISIBLE INFRARED SPIN SCAN RADIOMETER
Application of VISSR Atmospheric Sounder (VAS) data
[NASA-TM-82574] N84-23073
VISION
Some comparisons between NVL and oracle-based MRTD approaches — vision models
[BAE-BT-11240] N84-23096
A potentially powerful method of simple automatic recognition exhibiting scale and orientation independence — image processing
[BAE-BT-11088] N84-23102
Some observations on relative approaches to visual acquisition modelling
[BAE-BT-11241] N84-23104
VISUAL CONTROL
Control of dynamic systems based on graphic information N84-23159
VISUAL DISCRIMINATION
A potentially powerful method of simple automatic recognition exhibiting scale and orientation independence — image processing
[BAE-BT-11088] N84-23102
Some considerations of forms and distributions of receptive field units in early visual processing
[BAE-BT-11177] N84-23103
Detection of dotted forms in a structured visual noise environment
[AD-A138853] N84-23108
VISUAL PERCEPTION
Yellow ophthalmic filters in the visual acquisition of aircraft
[AD-A138536] N84-23097
The effect of haze on an operator's visual field and his target detection performance
[AD-A136330] N84-23099
Modelling of visual search performance
[BAE-BT-14586] N84-23106
VISUAL STIMULI
Some considerations of forms and distributions of receptive field units in early visual processing
[BAE-BT-11177] N84-23103
Detection of dotted forms in a structured visual noise environment
[AD-A138853] N84-23108
VOCODERS
Evaluation of the comprehension of non-continuous, sped-up vocoded speech: A strategy for coping with fading HF (High Frequency) channels
[AD-A138650] N84-22871
VOICE COMMUNICATION
Jam-resistant tactical communications N84-22828
Evaluation of the comprehension of non-continuous, sped-up vocoded speech: A strategy for coping with fading HF (High Frequency) channels
[AD-A138650] N84-22871
Preliminary analysis of automatic speech recognition and synthesis technology
[AD-A138976] N84-22877
VOICE DATA PROCESSING
Bibliography on direct voice input and direct voice output
[BAE-BT-12363] N84-23118
VOID RATIO
Compactness in semantics for merge and fair merge
[MC-IW-238/83] N84-23199
VOLATILITY
Geomorphic clues to the Martian volatile inventory: Landslides N84-23516
VOLCANOES
Geology, geochemistry, and geochronology of volcanic rocks between Cuauhtemoc and La Junta, central Chihuhua, Mexico N84-23066
Reports of planetary geology program, 1983
[NASA-TM-86246] N84-23431
Modeling Io volcanism: Maximum volcanic temperatures, depths of melting and magma composition N84-23436
Volcanic forms in the Kane Patera region, Io N84-23437
Chronology, morphology and stratigraphy of pumiceous pyroclastic-flow (ignimbrite) deposits from the eruption of Mount St. Helens on 18 May 1983 N84-23476
Classification of volcanoes of the Kane Patera Quadrangle of Io: Proportions of lava flows and pyroclastic flows N84-23477
Distribution and properties of small volcanoes in Acidalia Planitia N84-23478
The 1950 sulfur flow of Mauna Loa: Considerations for Io N84-23479
Effusion rate, length, and area relationships for some lava flows on Hawaii and Mount Etna with planetary implications N84-23482
The 19 March 1982 eruption and lahar at Mount Saint Helens: Implications for Martian outflow channels? N84-23495
Drainage evolution in the debris avalanche deposits near Mount Saint Helens, Washington N84-23496
Planetary geomorphology field studies: Iceland and Antarctica N84-23514

Thermal infrared analysis of volcanic surfaces: Mars and Hawaii N84-23524
Valles Marineris layered deposits: Implications of origin N84-23537

VOLCANOLOGY
Stratigraphic, geochemical, and petrologic studies of the Ammonoosuc volcanics, northcentral Massachusetts and southwestern New Hampshire N84-23059
East Butte: A volcanic dome of the Eastern Snake River Plain, Idaho N84-23475
The 1950 sulfur flow of Mauna Loa: Considerations for Io N84-23479
Volcanism in the Valles Marineris N84-23480
Volcanism in Elysium Planitia, Mars N84-23481
Experiments on water/melt explosions, nature of products, and models of dispersal N84-23483
Ridges on basalt flows N84-23484
Caleras in the solar system N84-23485
Geologic investigations of outer planets satellites [NASA-CR-173497] N84-23544

VOLTAGE REGULATORS
Three phase power factor controller [NASA-CASE-MFS-25535-2] N84-22885

VOLTERRA EQUATIONS
On nonlinear systems and algebraic geometry [RR-240] N84-23196
Linear Volterra convolution equations: Semigroups small solutions and convergence of projection operators [MC-TW-248/83] N84-23223

VORTEX GENERATORS
Numerical simulation of the tip vortex off a low-aspect-ratio wing at transonic speed [NASA-TM-85932] N84-22535

VORTEX RINGS
Energetics of vortex ring formation [AD-A136795] N84-22539
Experimental observations of vortex ring interaction with the fluid adjacent to a surface [AD-A136999] N84-22917

VORTICES
Experimental investigation of the low NO/sub x vortex airblast annular combustor [NASA-TM-83615] N84-22567
Film cooling on a gas turbine blade near the end wall [AD-A136794] N84-22569
Vortex motion in a precombustion chamber with intersecting jets [AD-A139040] N84-22717
Effect of rotation on thermal state of runner blade through effect on heat transfer on coolant side N84-22787
Visualisation of the vortex dominated flow around a delta wing-body combination using a water tunnel [BAE-821/RES/6631] N84-22904
Vortex generating flow passage design for increased film-cooling effectiveness and surface coverage — aircraft engine blade cooling [NASA-TM-83617] N84-22909
Bellows flow-induced vibrations [NASA-TM-82556] N84-22912
Fan noise reduction achieved by removing tip flow irregularities behind the rotor - forward arc test configurations [NASA-TM-83616] N84-23235

VOYAGER PROJECT
Ongoing data reduction, theoretical studies and supporting research in magnetospheric physics [NASA-CR-173419] N84-23039
Photometry of icy satellites: How important is multiple scattering in diluting shadows? N84-23438
Comparison of Hapke's photometric theory with Voyager observations of Europa, Enceladus, Rhea and Mimas N84-23439
Voyager feature-fixed photometry of Iapetus N84-23440
New models for landform evolution on Io N84-23443
High-resolution color images of Io N84-23445
Short time-scale surface changes on Io N84-23447
Morphology of fresh craters on Ganymede and the origin of pedestal craters N84-23466
Classification of volcanoes of the Kane Patera Quadrangle of Io: Proportions of lava flows and pyroclastic flows N84-23477

VOYAGER 1 SPACECRAFT
A summary of whistlers observed by Voyager 1 at Jupiter [NASA-CR-173415] N84-23545

VULNERABILITY
Ignitibility studies of LOVA propellants — low vulnerability gun propellants N84-22678

W

WAFERS
Method for sequentially processing a multi-level interconnect circuit in a vacuum chamber [NASA-CASE-MFS-25670-1] N84-22884

WALKING
Cognitive performance change during a 6-hour hike at low temperature in simulated rain, at controlled walking rates [AD-A138358] N84-23100

WALL FLOW
Aerodynamic sound generation by turbulent boundary layer flow along solid and compliant walls [MPIS-116/1983] N84-23239

WALL PRESSURE
A universal 3-dimensional wall pressure correction method for closed rectangular subsonic wind tunnel test sections (displacement, downwash, streamline curvature) [ESA-TT-800] N84-22588

WALLS
Procedure for wall temperature measurement in a metal vapor laser N84-22777
A tectonic geomorphological classification of the walls of Valles Marineris N84-23518

WAR GAMES
Doing C2 (Command Control) experiments using war games [AD-P002875] N84-22836
Lanchester's equations and game theory [AD-P002877] N84-22838

WARFARE
A formulation and analysis of combat games [NASA-TM-85927] N84-22585

WARNING SYSTEMS
An experimental comparison of operator responses to voice and tone system warnings [BAE-8T-12051] N84-23117

WASHERS (SPACERS)
Constant force friction damper [NASA-CASE-MSC-20505-1] N84-22611

WASHINGTON
The 19 March 1982 eruption and lahar at Mount Saint Helens: Implications for Martian outflow channels? N84-23495
Drainage evolution in the debris avalanche deposits near Mount Saint Helens, Washington N84-23496
Planetary geomorphology field studies: Washington and Alaska N84-23501
The Corfu landslide: Analog to giant landslides on Mars N84-23513

WASPALOY
The cyclic behaviour of a powder Ni-base superalloy — aircraft engines [PNR-90182] N84-22743

WATER
Experiments on water/melt explosions, nature of products, and models of dispersal N84-23483
Is there radar evidence for liquid water on Mars? N84-23529

WATER EROSION
Fluvial erosion of impact craters: Earth and Mars N84-23494
Quantitative and experimental modelling of sapping networks N84-23500
Planetary geomorphology field studies: Washington and Alaska N84-23501
A regression model for the temporal development of soil pipes and associated gullies in the alluvial-fill valley of the Rio Puerco, central New Mexico N84-23502
Experiments examining the shapes of isolated bars in comparison with those occurring in braided rivers N84-23503
The erosion of streamlined islands, longitudinal grooves and scour marks: Implications to the origin of the Martian outflow channels N84-23504

WATER FLOW
Ice-covered volcanic water flows on Ganymede N84-23432
Fluvial drainage systems: Margaritifer Sinus and Agyre (NC, NE) quadrangles, Mars N84-23497

WATER RUNOFF
Atmospheric model development N84-22998

WATER TUNNEL TESTS
Visualisation of the vortex dominated flow around a delta wing-body combination using a water tunnel [BAE-821/RES/6631] N84-22904

WATER WAVES
Surface wave propagation over sinusoidally varying topography: Theory and observation [IOS-159-PT-1] N84-22922
Surface wave propagation over sinusoidally varying topography: Theory and observation [IOS-159-PT-2] N84-22923
Waves recorded off the Eddystone lighthouse. Data for September 1978 to August 1981 at position 50 deg 10 min N, 004 deg 15 min W: Summary analysis and interpretation report [IOS-132] N84-23090

WAVE ATTENUATION
Wave attenuation in periodic structures [AD-A138924] N84-22984

WAVE DIFFRACTION
Automatic elimination of static unbalance of rotor in anisotropic bearings N84-22803

WAVE DRAG
Wave drag of elongated astroid bodies at moderate supersonic flight velocities N84-22797

WAVE EQUATIONS
Automatic elimination of static unbalance of rotor in anisotropic bearings N84-22803
Asymptotic models for wave scattering from very rough surfaces N84-22883

WAVE PROPAGATION
Asymptotic models for wave scattering from very rough surfaces N84-22883
Surface wave propagation over sinusoidally varying topography: Theory and observation [IOS-159-PT-1] N84-22922
Surface wave propagation over sinusoidally varying topography: Theory and observation [IOS-159-PT-2] N84-22923
Wave attenuation in periodic structures [AD-A138924] N84-22984
New formulas for HED (Horizontal Electric Dipole), HMD (Horizontal Magnetic Dipole), VED (Vertical Electric Dipole), and VMD (Vertical Magnetic Dipole) subsurface-to-subsurface propagation [AD-A139030] N84-23187
New formulas that extend Norton's farfield elementary dipole equations to the quasi-nearfield range [AD-A139057] N84-23188
A new eigenfunction expansion and its application to waveguide acoustics [AD-A138946] N84-23236
External excitation of ion cyclotron drift waves in a two-ion species plasma [IPPJ-665] N84-23264

WAVE REFLECTION
Measuring roughness of ultrasmooth surfaces by reflectometric method N84-22807

WAVE SCATTERING
Asymptotic models for wave scattering from very rough surfaces N84-22883

WAVEFORMS
Target super-resolution compensation for coherent airborne radar utilizing spread spectrum waveforms [AD-A138545] N84-22866
Disturbance minimization techniques for linear, time-invariant dynamical systems [AD-A138915] N84-23185

WAVEGUIDES
Experience with development of sealed linear waveguide electron accelerators N84-22780
A new eigenfunction expansion and its application to waveguide acoustics [AD-A138946] N84-23236

WAVELENGTHS
Long wavelength limit of interchange instabilities [AD-A138943] N84-23047

WEAPON SYSTEMS
Exhaust plume induced fluctuations in the index of refraction at optical wavelengths N84-22624
Multi-sensor fusion, communications and information warfare [AD-P002895] N84-22855
DECISION TECHNOLOGY: The catalyst for acquisition improvement [AD-P002755] N84-23302
Computer Generated Acquisition Document System (CGADS) [AD-P002784] N84-23331
An automated airframe production cost model [AD-P002787] N84-23334
Improved management of support resources [AD-P002808] N84-23354
Quality assurance - Air Force Logistics Command [AD-P002816] N84-23361
Selection of multiple sources in weapon systems acquisition [AD-P002837] N84-23382

WEAPONS INDUSTRY
Selection of multiple sources in weapon systems acquisition [AD-P002837] N84-23382

WEAR
Measurements of elastohydrodynamic film thickness, wear and tempering behavior of high pressure oxygen turbopump bearings [NASA-CR-171008] N84-22960

WEATHER FORECASTING
AWOS (Automatic Weather Observing System) sensor evaluation. Transmissometer, forward-scatter meter and lidar ceilometer
[AD-A138743] N84-23074
Forecasting the windstorm of 12 May 1983 (Acension Day) — the Netherlands
[KNMI-TR-43] N84-23079
WEATHERING
Weathered stony meteorites from Victoria Land, Antarctica, as possible guides to rock weathering on Mars N84-23509
WEBS (SHEETS)
Instrumentation for sensing moisture content of material using a transient thermal pulse
[NASA-CASE-NPO-15494-2] N84-22935
Time optimal digital control of multi-unit paper web dynamics N84-22991
WEDGES
Exact solution to problem of interaction between wedge moving at supersonic velocity and interface of two gaseous media N84-22790
WEIBULL DENSITY FUNCTIONS
On obtaining physical meaning from the parameters in the Weibull distribution
[AD-A138574] N84-23206
A comparison of several alternatives to maximum likelihood for the Weibull distribution
[AD-A138721] N84-23208
WEIGHTING FUNCTIONS
An interpolation type inequality for a discrete weighted norm
[CTH-MATH-1983-30] N84-23213
WELD STRENGTH
Measurement of melt line penetration and heat flux during arc spot welding
[DE84-002013] N84-22962
Weld penetration variations
[DE84-007915] N84-22963
WELD TESTS
Measurement of melt line penetration and heat flux during arc spot welding
[DE84-002013] N84-22962
Weld penetration variations
[DE84-007915] N84-22963
WHALES
Oil shale extraction using super-critical extraction
[NASA-CASE-NPO-15656-1] N84-23012
WHISTLERS
A summary of whistlers observed by Voyager 1 at Jupiter
[NASA-CR-173415] N84-23545
WIDEBAND COMMUNICATION
Sidelobe cancelling techniques used in wideband systems N84-22822
Local network wideband interconnection alternatives
[AD-A138604] N84-22868
WIND (METEOROLOGY)
A one dimensional model for the study of upwelling
[INPE-2936-RPE/445] N84-23086
WIND DIRECTION
Meteorological investigations at the wind test site Pellworm
[GKSS-83-E-61] N84-23082
WIND EFFECTS
Untapped midwestern wind energy resource: Nocturnal low-level wind maxima
[DE84-006424] N84-23077
Wind abrasion on Venus: A means for experimental investigations N84-23455
Aeolian processes on Venus N84-23456
Wind streaks on Mars: Comparisons of production models with observations of bright streaks N84-23486
Desert pavement study at Amboy, California N84-23492
WIND EROSION
Martian dust storms witnessed by Viking Lander 1 N84-23487
Wind erosion and dune formation on high frozen bluffs N84-23493
Radar-visible wind streaks in the Altiplano of Bolivia N84-23527
The case for aeolian control of meter-scale surface texture on Mars N84-23528
WIND MEASUREMENT
Performance and size estimating for wind systems foi MF
[DE84-006980] N84-23033
Study of wind scatterometer antenna for ERS-1. Volume 1: Executive summary report
[Y/A-3380] N84-23080
Study of windscatterometer antenna for ERS-1
[MIX/A-3188] N84-23081
Meteorological investigations at the wind test site Pellworm
[GKSS-83-E-61] N84-23082
WIND PRESSURE
Performance and size estimating for wind systems foi MF
[DE84-006980] N84-23033
WIND PROFILES
Untapped midwestern wind energy resource: Nocturnal low-level wind maxima
[DE84-006424] N84-23077
Wind abrasion on Venus: A means for experimental investigations N84-23455
Aeolian processes on Venus N84-23456
WIND TUNNEL MODELS
A universal 3-dimensional wall pressure correction method for closed rectangular subsonic wind tunnel test sections (displacement, downwash, streamline curvature)
[ESA-TT-800] N84-22588
WIND TUNNEL TESTS
Experimental investigation of the internal flow field in STOL engine inlets N84-22544
Post-test data report for the space shuttle full-scale AFRSI sequence of environments test (OS-305-1 to -5) in the NASA/Ames Research Center 11x11-foot wind tunnel
[NASA-CR-167684] N84-22603
Combustion performance of a vitiated air heater for a freejet test facility N84-22691
Aeolian processes on Venus N84-23456
WIND TUNNEL WALLS
La Recherche Aerospatiale, Bimonthly bulletin, number 1983-4, 215/July-August
[ESA-TT-823] N84-22589
WIND TURBINES
Wind and solar powered turbine
[NASA-CASE-NPO-15496-1] N84-23018
WIND VARIATIONS
Waves recorded off the Eddystone lighthouse. Data for September 1978 to August 1981 at position 50 deg 10 min N, 004 deg 15 min W: Summary analysis and interpretation report
[IOS-132] N84-23090
WIND VELOCITY
Performance and size estimating for wind systems foi MF
[DE84-006980] N84-23033
Meteorological investigations at the wind test site Pellworm
[GKSS-83-E-61] N84-23082
Velocities of windblown particles in saltation: Venus, Earth, and Mars N84-23491
WINDOWS (APERTURES)
Evaluating multiple coordinated windows for programming workstations N84-23146
Light transmitting window assembly
[NASA-CASE-MSC-18417-1] N84-23251
WINDPOWER UTILIZATION
Wind and solar powered turbine
[NASA-CASE-NPO-15496-1] N84-23018
Wind energy test field Pellworm: Tests of the plant Bruemmer BW 120S
[GKSS-83-E-42] N84-23035
Untapped midwestern wind energy resource: Nocturnal low-level wind maxima
[DE84-006424] N84-23077
WINDPOWERED GENERATORS
Wind energy test field Pellworm: Tests of the plant Bruemmer BW 120S
[GKSS-83-E-42] N84-23035
WING CAMBER
Slotted variable camber flap
[NASA-CASE-LAR-12541-1] N84-22551
WING FLAPS
Slotted variable camber flap
[NASA-CASE-LAR-12541-1] N84-22551
WING FLOW METHOD TESTS
Theory of hypersonic three-dimensional flow of nonsteady gas stream with relaxation past thin wing with arbitrary aspect ratio N84-22791
WING OSCILLATIONS
Excitation of Tollmin-Schlichting waves in boundary layer at vibrating surface of infinite-span sweptback wing N84-22792
WING SLOTS
Slotted variable camber flap
[NASA-CASE-LAR-12541-1] N84-22551
WORKLOADS (PSYCHOPHYSIOLOGY)
Human decisionmaking in dynamic environments with increasing information processing demands
[AD-P002684] N84-22845
Assessing contracting workforce requirements in the matrixed organization
[AD-P002760] N84-23307
WORLD DATA CENTERS
Integrated Global Ocean Services System (IGOSS): Guide to the IGOSS data processing and services system
[WMO-623] N84-23089
WORLD METEOROLOGICAL ORGANIZATION
World Weather Watch: The plan and implementation program, 1984-1987
[WMO-617] N84-23078
Integrated Global Ocean Services System (IGOSS): Guide to the IGOSS data processing and services system
[WMO-623] N84-23089
WYOMING
Interpretation of planetary stress systems: Determination of tectonic over-printing in Northwest Wyoming N84-23540

X

X RAY ANALYSIS
Flash X-ray with image enhancement applied to combustion events N84-22666
X RAY APPARATUS
A novel X-ray backlighting method for Rayleigh-Taylor instability measurements on ablatively driven targets
[AD-A138644] N84-22937
X RAY SPECTROSCOPY
X-ray photoelectron and Auger electron spectroscopic study of the CdTe surface resulting from various surface pretreatments: Correlations of photoelectrochemical and capacitance-potential behavior with surface chemical composition
[AD-A138601] N84-22714
X RAY TELESCOPES
A normal incidence, high resolution X-ray telescope for solar coronal observations
[NASA-CR-173518] N84-23412

Y

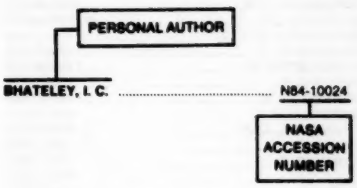
YAG LASERS
Laser drilling of aero engine components
[PNR-90185] N84-22958
YAW
A new satellite instrument for yaw and pitch measurements
[AD-A138729] N84-22599
YUKON TERRITORY
Age and evolution of the Yukon-Tanana Terrane, southeastern Yukon Territory N84-23060

Z

ZIRCONIUM OXIDES
Separator development and testing of nickel-hydrogen cells
[NASA-TM-83653] N84-22712
Characterization of zirconium alloy oxidation films by alternating current impedence
[DE84-006225] N84-22766

PERSONAL AUTHOR INDEX

Typical Personal Author Index Listing



Listings in this index are arranged alphabetically by personal author. The NASA accession number denotes the number by which the citation is identified.

A

ABBASI-GHELMANSARAI, F. N84-23222
ABIRI, A. A. N84-23167
ACHOUR, A. N84-23180
ACKER, D. D. N84-23367
ADAMS, K. E. N84-22641
ADAMS, M. L. N84-22977
ADLER, F. L. N84-23368
ADLER, L. N84-22970
AFSAR, M. N. N84-23253
AGGARWAL, B. B. N84-23013
AGRESTI, W. N84-23150
AHRENS, T. J. N84-22741
AKIN, D. L. N84-23119
ALBERT, K. W. N84-22866
ALBERTS, J. R. N84-23092
ALBINI, J. C. N84-23363
ALEXANDROV, A. N84-23397
ALI, A. W. N84-22947
N84-23266
ALLCOCK, H. R. N84-22750
ALLEN, E. M. N84-22739
ALLEN, R. F. N84-23356
ALLISON, M. L. N84-23432
N84-23540
ALRED, J. W. N84-22626
AMBRUSO, R. N84-22623
AMIMOTO, S. T. N84-22950
AMMERMAN, H. N84-22550
ANDERSON, O. A. N84-23269
ANDERSON, R. D. N84-22667
ANDERSON, S. B. N84-22532
N84-22584
ANDERSSON, M. N84-23189
ANDREO, R. H. N84-22865
ANDREWS, D. G. N84-22551
ANDREWS, J. W. N84-22548
ANDREYCHENKO, K. P. N84-22789
ANTHONY, S. J. N84-23042
AOKI, T. N84-23181
ARCIERI, J. D. N84-23350
ARDALAN, S. H. N84-22901
ARDEMA, M. D. N84-22585
ARGABRIGHT, T. A. N84-22920
ARKERYD, L. N84-22926
ARNOLD, R. S. N84-23128
ARON, K. N84-22636
N84-22683
ARONS, I. J. N84-23113
ASADZADEH, M. N84-23246
ASHWORTH, T. N84-22938
ASKINS, D. R. N84-22762
ASKINS, R. E. N84-22680
ASMEROM, Y. N84-23526
ATHANS, M. N84-22835
N84-22864
ATKINSON, L. A. N84-22945
ATTENBOROUGH, K. N84-23046
AUGL, J. M. N84-22703
AUGUST, G. N84-23267
AUNGST, W. P. N84-22668
AUNON, J. I. N84-23107
AVERY, V. F. N84-23471
AZAREWICZ, J. N84-22894
AZZAZY, M. N84-22633

B

BAILEY, J. N84-22822
N84-22833
BAIRD, C. B. N84-23368
BAKER, C. B. N84-23546
BAKER, C. R. N84-22768
BAKER, V. R. N84-23494
N84-23513
BALAGEZYAN, D. N84-23393
BALCH, C. D. N84-22907
BALLANTINE, R. B. N84-22895
BALOGA, S. N84-23474
N84-23482
BAMFORD, A. C. N84-22660
BANERDT, B. N84-23452
N84-23490
BANKS, B. A. N84-22895
N84-22896
N84-23095
BANKS, S. P. N84-23196
N84-23222
BANKSTON, B. F. N84-22926
BANNISTER, P. R. N84-23187
N84-23188
BARBATO, M. A. H. N84-23099
BARKAKATI, N. N84-22883
BARLOW, J. N84-22756
BARLOW, N. G. N84-23462
BARNES-FARRELL, J. L. N84-23112
BARNES, C. W. N84-23542
BARNETT, S. N84-23526
BARR, D. R. N84-23215
BARR, S. W. N84-22716
N84-22718
BARRETT-GULTEPE, M. A. N84-22755
BARRY, C. P. N84-22967
N84-22968
BARRY, J. M. N84-23294
N84-23380
BARZ, F. N84-22721
BASILI, V. R. N84-23138
N84-23139
BATILL, S. M. N84-22540
BAUMGARTNER, J. S. N84-23336
BAUTIN, S. P. N84-22785
BAYER, G. N84-22729
BAZHENOV, V. G. N84-22798
BAZIN, C. N84-22946
BEACH, G. L. N84-23495
N84-23498
BEALE, E. M. L. N84-22860
BEAN, S. J. N84-23206
N84-23208
BEASLEY, M. R. N84-23285
BEAUDRY, D. N84-23068
BECKER, E. J. N84-22809
BECKSTEAD, J. W. N84-23111
BELL, J. F. N84-23453
BELL, K. R. N84-23017
BELOTSERKOVSKIY, O. M. N84-22784
BELOTSERKOVSKIY, S. M. N84-22784
BEN-REUVEN, M. N84-22644
N84-22656
BENNETT, H. W. N84-22578
BENZ, F. J. N84-22598
BERGER, R. W. N84-23125
BERGHER, M. N84-22946
BERGSTRA, J. A. N84-23219
BERKNER, K. H. N84-23269
BERLEKAMP, E. N84-22829
BERLINER, Y. N84-23392
BERNARD, R. N84-23018
N84-23055
BERT, C. W. N84-22981
BERTSEKAS, D. P. N84-22840
N84-23154
BETTINI, R. G. N84-22906
BEVERLY, J. G. N84-23326
N84-23381
BEYER, R. A. N84-22672
BHANGU, J. K. N84-22573
N84-22582
BHAVNANI, K. H. N84-22616
BIAGI, L. A. N84-23269
BIAGLOW, J. A. N84-22585
N84-22587
BICE, W. S., JR. N84-23240
BIELAK, M. N84-22639
BIER, R. E. N84-22899
BILL, R. C. N84-22957
BILLARDON, M. N84-22946
N84-23255
BJORKLUND, R. A. N84-22892
BLACK, J. D. N84-22572
BLACKWELL, R. N84-23032
BLAKE, P. L. N84-23530
BLAMBERT, M. N84-23177
BLITZ, A. N84-22858
BLOCK, M. G. N84-23097
BLOMMER, E. J. N84-22658
BLUM, L. N84-23182
N84-23207
BLUMENTHAL, W. N84-22764
BOBYARCHICK, A. R. N84-23067
BODVARSSON, G. S. N84-23014
N84-23030
BOESINGER, T. N84-23052
BOGGS, T. L. N84-22682
BOMAR, B. W. N84-22900
BONDALETOV, V. N. N84-23232
BONELLO, F. J. N84-23326
N84-23381
BONO, T. L. N84-23297
BOOTHROYD, J. C. N84-23497
BORELL, C. N84-23212
BORSHCIYEVSKIY, V. M. N84-22776
BOSCO, S. R. N84-22770
N84-23430
BOTT, L. C. L. N84-23549
BOWERS, C. J. N84-22871
BOWLES, R. N84-22549
BOWMAN, R. E. N84-22668
BOYCE, J. M. N84-23473
BOYER, D. W. N84-22628
BOYLE, R. J. N84-22564
N84-22911
BRAILE, L. W. N84-23008
BRAUN, H. M. N84-23080
N84-23081
BRECHTEL, D. L. N84-23320
BREED, C. S. N84-23511
BRES, E. V. N84-22736
BRETCHES, J. E. N84-23475
BRINKLEY, J. W. N84-23121
BROBST, W. D. N84-23430
BRODMAN, B. W. N84-22669
BROST, E. J. N84-23320
BROTE, W. N84-22961
BROUGHTON, T. N84-22815
BROWN, C. N84-23336
BROWN, C. W. N84-22575
BROWN, F. N84-23252
BROWN, M. A. N84-23441
BROWN, N. J. N84-23259
BROWN, P. N84-23361
BROWN, R. S. N84-22843
BROWN, R. V. N84-22850
BRUEGMANN, J. N84-23035
BRUNDIGE, W. N. N84-22681
BRUSIUS, P. G. N84-23279
BRYANT, C. N84-22919
BRYANT, N. A. N84-23004
BUCCIARELLI, M. A. N84-23330
BUCHAU, J. N84-23044
BUCHMANN, J. N84-23072
BUCKLEY, E. C. N84-22583
BURATTI, B. N84-23438
N84-23439
BURCHELL, D. J., JR. N84-22751
BURKS, H. D. N84-22749

BURNHAM, D. C. N84-23074
BURNS, S. J. N84-22989
BURNS, W. C. N84-22697
N84-22982
BUROV, I. S. N84-22798
BUSNAINA, A. A. N84-22927
BUTCHER, A. G. N84-22658
BUTLER, N. N84-22705
BUTTERWORTH, J. R. N84-23322
BUTTON, K. J. N84-23253
BYCHKOV, Y. I. N84-22782
BYVIK, C. E. N84-23019

C

CAITO, S. A. N84-23153
CALEY, L. N84-22705
CALLEN, E. N84-22758
CAMPBELL, D. B. N84-23460
CAMPBELL, G. N84-23353
CAMPBELL, G. E. N84-22611
CAPPS, C. D. N84-23257
CARD, D. N84-23136
N84-23138
N84-23150
CARMICHAEL, R. S. N84-23005
CARPENTER, T. W. N84-22693
CARPER, D. M. N84-22975
CARR, M. H. N84-23435
N84-23498
CARR, M. J. N84-22953
CARTER, J. E. N84-22537
CASEY, A. W. N84-22706
CASSINELLI, J. E. N84-23021
CASTANON, D. A. N84-22662
CASTILLA, F. N84-22810
CASTLE, K. R. N84-23002
CATALDO, R. L. N84-23024
CAWLEY, J. D. N84-22563
CAYLOR, M. J. N84-22540
CERRA, A. W., JR. N84-22917
CHAMIS, C. C. N84-22702
CHAN, J. W. N84-22940
CHAN, S. C. N84-22647
CHANDLER, J. A. N84-22605
CHANDRASEKARAN, B. N84-23341
N84-23344
CHANG, F. K. N84-22992
CHANG, I. S. N84-22538
CHANG, T. S. N84-22863
CHARLES, J. P. N84-22587
CHARMAN, D. N84-22888
CHASE, A. N84-22950
CHAUSHANSKIY, S. A. N84-22781
CHEN, A. G. N84-22568
CHEN, C. T. N84-23183
CHEN, F. L. N84-22646
CHEN, H. P. N84-22569
CHEN, P. K. K. N84-22760
CHEN, T. S. N84-22744
CHENG, C. H. N84-22744
CHERNOV, Y. N. N84-23232
CHESHIRE, L. F. N84-23362
CHIARAMONTE, F. P. N84-22566
CHILACHAVA, T. I. N84-22783
CHIMA, R. V. N84-22527
CHIU, D. N84-22665
CHONG, C. Y. N84-22857
N84-22878
CHOTAI, A. N84-22612
N84-22617
N84-23166
N84-23167
CHRISTENSEN, P. N84-23479
N84-23526
N84-23527
CHUAH, C. K. N84-22961
CHUDNOVSKY, A. N84-22980
CHUNG, T. J. N84-22647
CHUNG, Y. J. N84-23114
CHURCH, V. N84-23136
N84-23150
CLARK, B. V. N84-23007
CLARK, D. P. N84-22650
CLARK, P. E. N84-23531
N84-23532
N84-23533
CLAUS, R. O. N84-22932
CLAYTON, K. I. N84-22988
CLELAND, D. I. N84-23369
CLIFFORD, S. M. N84-23432
CLOW, G. D. N84-23435
N84-23470
CLOYD, R. A. N84-22609
COBLIN, R. D. N84-22876
COCHRUN, B. L. N84-22870
COCKERHAM, J. M. N84-23300
COE, C. F. N84-22934
COHEN, A. N84-22673
COHEN, L. M. N84-22635
COHEN, M. M. N84-22612
COHEN, M. S. N84-22650
N84-22653
COHEN, N. S. N84-22685
COLACHICO, J. M. N84-23357
COLBURN, D. S. N84-23488
COLE, A. E. N84-23076
COLLINS, D. J. N84-23074
COLLINS, O. M. N84-23347
COMPTON, L. E. N84-22709
N84-23012
CONDIT, C. D. N84-23502
CONNELLY, D. L. N84-23251
CONNELLY, E. M. N84-23145
CONSOLMAGNO, G. N84-23433
COOK, A. F. N84-23434
COOK, C. R. N84-23208
COOK, L. M. N84-23259
COOK, M. K. N84-23184
COOKE, K. J. N84-23106
COOLIDGE, M. B. N84-22680
COOPER, L. N84-23301
COOPER, W. S. N84-23269
COPLIN, J. F. N84-22577
COSTA, M. F. N84-22682
COSTELLO, F. A. N84-22608
COX, J. E. N84-23370
COX, P. G. N84-22556
CRAIG, J. N84-22633
CRAIG, L. J. N84-22899
CRAMER, R. G. N84-22659
CRISTI, R. N84-23169
CRISWELL, C. W. N84-23476
CROONQUIST, A. P. N84-23233
CROSS, L. E. N84-23270
CROWLEY, J. L. N84-23123
CRUMPLER, L. S. N84-23436
CULICK, F. E. C. N84-22686
CURRIT, P. A. N84-23147
CUTRIM, E. M. C. N84-23069
CZARNECKI, S. V. N84-22872

D

DALE, C. B. N84-22640
DALLEN, J. A., JR. N84-22902
DAMRON, S. N84-23267
DANIEL, B. R. N84-22646
DANIELSON, G. E. N84-23442
DANILOV, A. Y. N84-22781
DARDEN, C. M. N84-22906
DASCHBACH, J. N84-23326
N84-23381
DAUBE, F. G. N84-22987
DAULERIO, L. A. N84-22545
DAVIES, A. G. N84-22922
N84-22923
DAVIS, P. A. N84-23454
N84-23523
DAVIS, R. L. N84-22537
DAVIS, R. M. N84-23365
DAVISSON, W. I. N84-23326
N84-23381
DAVYDOV, Y. M. N84-22784
DEACON, D. A. G. N84-22946
N84-22949
N84-23255
DEBAKKER, J. W. N84-23199
DEBOER, U. P. N84-22600
DEGROOT, W. A. N84-22689
DEHON, R. A. N84-23469
N84-23512
DEKONING, A. U. N84-22990
DELANEY, J. R. N84-22856
DELFAU, J. L. N84-22727
DELLAMUSSIA, J. P. N84-23227
DEMONG, R. F. N84-23323
DENNEY, R. O. N84-22528
DENNIS, B. K. N84-23377
DERYABIN, S. L. N84-22785
DEVINE, M. P. N84-22669
DEVRIES, J. N84-23194
DEWILDE, M. N84-23175
DEWILDE, M. A. N84-22672
DHINGRA, B. S. N84-22711
DICKMAN, T. J. N84-23362
DIGIACOMO, A. F. N84-22897
N84-22982
DILLARD, J. F. N84-23341
N84-23344
DINERSTEIN, H. L. N84-23411
DINGER, R. N84-22826
DINGUIRARD, M. N84-23002
DIPPOLITO, D. A. N84-23273
DIPPOLITO, E. N84-23133
DIREKTOR, L. B. N84-22777
DITTMAR, J. H. N84-23235
DIXON, D. S. N84-22596
DIYESPEROV, V. N. N84-22796
DOALI, J. O. N84-22668
DOERFLINGER, C. W. N84-23139
DOHERTY, F. E. N84-23373
DOLLYHIGH, S. M. N84-22553
DOMAIN, J. S. N84-23368
DONNELLAN, T. M. N84-22761
DONOVAN, L. F. N84-22533
DOORMAN, K. W. F. M. N84-23238
DOREY, R. C. N84-22770
DORNHOEFER, G. N84-23244
DORNY, C. N. N84-22874
DOSCHEK, G. A. N84-23548
DOWDLE, J. R. N84-22637
DOWNING, E. J., JR. N84-23340
DOWNS, D. N84-22665
DOWNS, G. S. N84-23532
N84-23533
DOZIER, J. N84-22997
DOZONO, S. N84-22852
DRAGAN, M. N84-23283
DRAGHICI, I. N84-23283
DRAPER, S. W. N84-23155
DRESS, W. B. N84-22939
DUBOIN, M. L. N84-23054
DUCOT, E. R. N84-22635
DUEX, T. W. N84-23066
DUFRANE, K. F. N84-22960
DUNBAR, R. S. N84-23449
DUNLAP, R. N84-22643
DUNN, T. J. N84-22601
DUPRE, G. N84-22726
N84-22921
DUPREE, J. N84-22823
DUPREE, J. E. N84-22824
DZURISIN, D. N84-23496

E

EARDLEY, B. R. N84-22582
EBINGER, M. H. N84-22680
ECUNG, M. N84-23295
EDELBLUTE, M. C. N84-23383
EDELMAN, R. B. N84-22690
EDINGTON, R. J. N84-22659
EDWARDS, J. B. N84-22816
EFFLAND, D. N84-23156
EGGLESTON, D. S. N84-22619
N84-22632
EHLERS, K. W. N84-23269
EL-AASSER, M. S. N84-22739
ELISCHER, E. N84-23029
ELLEAUME, P. N84-22946
N84-23255
ELLEMAN, D. D. N84-23233
ELSTON, W. E. N84-23476
N84-23477
N84-23502
ENGELMANN, P. D. N84-23110
EPSTEIN, E. E. N84-23550
ERAT, K. N84-22668
ERICKSEN, R. H. N84-22541
ERIKSSON, K. N84-23198
ERVIN, L. C. N84-23358
ESCHER, W. J. D. N84-22768
ESTEY, R. S. N84-22931
ETZLER, C. C. N84-23080
N84-23081
EVANS, A. G. N84-22764
EVANS, J. L. N84-23116
EZRA, C. E. N84-23002

F

FABER, D. E. N84-22659
FANALE, F. P. N84-23451
N84-23452
N84-23490
FARAJI, S. N84-22998
FARGHER, J. S. W., JR. N84-23359
FAROUHARSON, S. N84-22719
FARRELL, R. A. N84-22865
FATTI, L. P. N84-23171
FEDOTOV, S. I. N84-22781
FELCH, K. L. N84-22899
FELDMAN, U. N84-23548

FELDMEIER, D. C. N84-23164
FENDELL, J. N84-22636
FENDER, D. A. N84-22545
FERGUSON, H. M. N84-23499
FIEDLER, E. N84-22731
FIFER, R. A. N84-22681
N84-22684
FITZKY, H. G. N84-22729
FLANDRO, G. A. N84-22648
FLANIGAN, D. A. N84-22680
FLEMING, D. P. N84-22562
FLIGG, C., JR. N84-22550
FLOOR, C. N84-23079
FOGARTY, W. G. N84-23550
FOGG, T. R. N84-23038
FOHLEN, G. M. N84-22697
N84-22745
FOLEY, R. N84-22964
FOLEY, R. T. N84-22737
FOLLE, M. I. N84-22797
FOMIN, N. A. N84-22728
N84-22921
FORBES, G. S. N84-23079
FORSBERG, C. A. N84-23045
FORTNUM, B. C. H. N84-23090
FOSS, W. E., JR. N84-22553
FOSTER, R. W. N84-22768
FOWKES, F. M. N84-22739
FOWLER, J. R. N84-22767
FOX, J. A. N84-22945
FOX, J. E. N84-23170
FOX, L. J. N84-22899
FRANCA, Z. M. P. D. S. N84-23406
FRANKLIN, J. A. N84-22564
FRANKLIN, L. A. N84-23208
FREDERICK, R. A., JR. N84-22638
FREEDMAN, E. N84-22675
FRENZEN, P. N84-23077
FRESNEL, J. N84-23174
FREY, H. N84-23478
FRIBERG, J. N84-23197
FRIEDLANDER, A. N84-22594
FRIES, S. N84-23035
FRISCH, F. A. P. N84-23371
FROIDEVAUX, L. N84-23058
FROMER, H. S. N84-23327
FUCHKO, V. Y. N84-22778

G

GALLAGHER, C. C. N84-23045
GAPOSCHKIN, E. M. N84-23048
GARCIA, R. D. N84-22903
GARDINER, P. C. N84-23333
GARETT, B. C. N84-22630
GARMEZY, L. N84-23065
GARNER, J. P. N84-23068
GARRIS, C. A. N84-22539
GARVIN, J. B. N84-23459
N84-23461
GAT, N. N84-22635
GAUNAURD, G. C. N84-22756
GAVRILOV, D. N. N84-22779
GAY, C. H., JR. N84-22560
GEE, J. M. N84-22953
GELDER, T. F. N84-22533
GELYETOV, V. P. N84-23232
GENCO, L. V. N84-23099
GENDRON, B. N84-23154
GENDRON, R. F. N84-22837
GENT, A. N. N84-22757
N84-22758
GENZEL, R. N84-23411
GERHAUSER, H. N84-23275
GERLACH, C. R. N84-22912
GERRITSEN, F. A. N84-23165
GETTYS, C. F. N84-23110
N84-23111
GEYER, M. S. N84-22654
GIBBONS, R. T. N84-23374
GIBSON, D. G. N84-23250
GIBSON, E. K., JR. N84-23510
GILL, D. N84-23379
GILL, J. H. N84-23304
N84-23360
GINTY, C. A. N84-22702
GLASS, D. V. N84-23354
GLICK, R. L. N84-22639
N84-22645
GLOTFELTY, M. F. N84-23542
GOBIEN, J. N84-22828
GODLEWSKI, M. P. N84-23027
GOEBEL, A. J. N84-23307
GOEL, A. L. N84-23143
GOGUEN, J. N84-23440
GOLD, B. N84-22671
GOLDSTEIN, R. J. N84-22569
GOLDSTEIN, S. H. N84-22842
GOLUB, L. N84-23412
GOLUBYATNIKOV, A. N. N84-22783
GONZALEZ-SANABRIA, O. D. N84-22712
N84-23023
N84-23025
N84-23026
GONZALEZ, V. H. N84-22673
GOOD, J. C. N84-23429
GOODING, J. L. N84-23509
GOODMAN, I. R. N84-22841
GOODMAN, J. J. N84-23426
GORDON, J. G., II N84-22721
GORE, P. J. W. N84-23064
GORYACHUK, O. L. N84-22781
GOSHGARIAN, B. B. N84-22680
GOTTSCHALK, G. N84-23317
GOUGH, P. S. N84-22662
N84-22663
GRABOWSKIY, A. N84-22665
GRAF, J. E. N84-23020
GRAFF, C. J. N84-22632
GRAHAM, K. J. N84-22659
GRAHAM, P. H. N84-22676
GRAMANN, W. N84-23290
GRANATA, R. D. N84-22739
GRANT, J. A. N84-23497
GRANTHAM, C. N84-23146
GRAS, G. N84-23173
GRATTON, M. N84-22769
GRAY, R. M. N84-23124
GREELEY, R. N84-23455
N84-23456
N84-23466
N84-23479
N84-23491
N84-23492
N84-23526
N84-23527
GREEN, A. E. S. N84-22629
GREEN, P. E. N84-22656
GREENE, D. E. N84-22554
GREENSTADT, E. W. N84-23039
GREENWOOD, T. D. N84-22746
GREER, W. R., JR. N84-23342
GREITZER, F. L. N84-22847
GRIEM, H. R. N84-22947
GRIGORENKO, Y. M. N84-22805
GRINER, T. N84-23126
GRINGORTEN, I. I. N84-23076
GROLIER, M. J. N84-23511
GRONSKY, R. N84-23287
GROSS, S. N84-23028
GROVEMAN, B. N84-23134
GRUN, J. N84-22937
N84-22952
GUARD, C. P. N84-23075
GUERNSEY, C. S. N84-22625
GUICE, R. L. N84-22919
GUINNESS, R. E. A. N84-23487
GULTEPE, M. E. N84-22755
GURNETT, D. A. N84-23545
GURULE, R. L. N84-23525
GUSENKOV, A. P. N84-22799
N84-22800
GUYER, K. L. N84-22718
N84-22720
GUYTON, R. D. N84-23375
GUZDAR, P. N. N84-23043

H

HAAS, J. E. N84-22564
HACK, W. N84-23244
N84-23245
HACKETT, R. M. N84-22847
HAI, N. X. N84-23178
HAIMERL, M. N84-23080
N84-23081
HAJEK, T. N84-22568
HALL, J. F., II N84-23152
HALL, J. L. N84-23534
HALL, R. L. N84-22986
HALL, S. A. N84-22844
HALLER, E. E. N84-23286
HAMEETMAN, G. J. N84-22600
HAMILTON, L. J. N84-23087
HANNA, M. F. N84-22931
HANNAN, P. W. N84-22875
HANSEN, B. J. N84-22659
HANSEN, R. C. N84-22867
HANSON, J. M. N84-22608
HANSON, R. K. N84-22637
HANUISE, C. N84-23055
HARDWICK, W. N84-22894
HARDY, T. L. N84-22631
HARGIS, P. J., JR. N84-22953
HARGROVE, J. W., JR. N84-23382
HARMAN, W. H. N84-22548
HARMON, S. N84-23122
HARRIS, A. E. N84-22561
HARRIS, L. E. N84-22636
N84-22683
HARRISON, T. G. N84-23344
HARSHA, P. T. N84-22690
HARTMANN, W. K. N84-23487
HATFIELD, J. N84-23510
HAUSER, D. N84-22960
HAUSMANN, M. D. N84-23099
HAWKE, B. R. N84-23453
HAWKE, H. R. N84-23519
HAWKINS, D. M. N84-23171
HAWKINS, H. L. N84-22573
HAZEWINKEL, M. N84-23193
HEAD, J. W. N84-23441
N84-23443
N84-23458
N84-23459
N84-23460
N84-23481
N84-23519
N84-23534
HEAD, R. C. N84-23321
HEAP, N. W. N84-23048
HEARON, B. F. N84-23121
HEATH, B. A. N84-22967
N84-22968
HEATHCOTE, R. M. N84-22574
HEATHERSHAW, A. D. N84-22922
N84-22923
HED, P. P. N84-23260
HEDBERG, L. I. N84-23178
HEGDE, U. G. N84-22642
HEIJNEN, C. J. H. N84-23269
HEINZ, H. A. N84-23305
HELFENSTEIN, P. N84-23459
HELIN, E. F. N84-23449
HELLER, B. N84-23032
HELLER, C. N84-22609
HELLER, P. L. N84-23063
HENDLER, E. N84-23101
HENRY, C. R. N84-23363
HENRY, R. N84-22671
N84-22678
HERGENROTHER, P. M. N84-22747
HERKENHOFF, K. E. N84-23485
HERRMANN, H. N84-22955
HERSHMAN, R. L. N84-22847
HERZAU, J. S. N84-23026
HESS, G. M. N84-23257
HEYMANN, M. N84-22585
HICKEY, P. J. N84-22859
HICKS, M. A. N84-22575
N84-22743
HILL, J. M. N84-22531
HINZE, W. J. N84-23008
HIRANO, K. N84-23263
HIRATA, M. H. N84-23072
HOBERECHT, M. A. N84-23022
N84-23023
HODSON, J. A. N84-22706
HOFFMAN, J. J. N84-22540
HOFFMAN, R. J. N84-22621
N84-22622
HOFFMAN, S. J. N84-22595
HOFLAND, R., JR. N84-22950
HOLLENBACH, D. N84-23411
HOLM, R. N84-22729
HOLM, R. G. N84-23002
HOLMAN, L. K. B. N84-23105
HOLMES, J. N84-23401
HOLMES, M. N84-23018
HOLROYD, T. J. N84-22571
HOLT, H. E. N84-23431
HOLT, M. N84-22914
HOMES, H. E. N84-22873
HOOGTERP, F. B. N84-23153
HOPKINSON, J. A. N84-23115
HORD, D. J. N84-23100
HORNER, V. M. N84-23486
HORST, A. W. N84-22663
N84-22664
N84-22679
HOUGHTON, E. N84-22888
HOVANEC, J. W. N84-23157
HOWARD, A. D. N84-23500
HOWARD, R. D. N84-23119
HOWE, R. D. N84-22637
HOWERTON, Y. F. N84-23308

HREBIEN, L. N84-23101
HSIEH, W. H. N84-22677
HSU, I. C. N84-23162
HU, G. N84-22699
HUBA, J. D. N84-23043
N84-23047
HUBBARTT, J. E. N84-22689
HUDSON, D. M. N84-23121
HUEY, H. E. N84-22899
HUGUENIN, R. N84-23520
HUMPHRY, D. E. N84-23093
HUNT, B. R. N84-23254
HUNT, M. S. N84-22905
HUPP, J. T. N84-22721
N84-22722
N84-22723
N84-22724
N84-22725
N84-23264
HWANG, C. S. N84-23237
HYER, M. W. N84-22975

I

IKEZAWA, S. N84-23264
ILGEN, D. R. N84-23112
IMRE, L. N84-22729
INGALLS, T. N84-23370
INGEBO, R. D. N84-22910
INGERT, G. K. N84-22774
IPPOLITOV, A. S. N84-22717
IRDUMSA, J. Z. N84-22539
IRVING, A. N84-23117
N84-23118
ISELER, G. W. N84-23282
IVAKHNOV, A. N84-23396
IVANOV, B. N. N84-22806
IZUMI, Y. N84-23076

J

JACKSON, R. D. N84-23002
JACKSON, R. G. N84-22973
JAGODA, J. I. N84-22689
JANDL, O. N84-23262
JANNEY, J. L. N84-22680
JEDLOVEC, G. J. N84-23073
JOBE, M. D. N84-22809
JOHNSON, E. R. N84-22975
JOHNSON, K. B. N84-23348
JOHNSON, P. E. N84-22966
JOHNSON, S. M. N84-22565
N84-22567
JOHNSON, T. V. N84-23521
JONES, B. N84-23413
N84-23414
JONES, G. N84-22550
JONES, R. A. N84-23184
JORDAN, F. W. N84-22641
JORY, H. R. N84-22899
JOURDAIN, J. L. N84-23050
N84-23051
JUHASZ, A. A. N84-22668
JUNTZ, R. N84-22964
JURGENS, R. F. N84-23532
N84-23533

K

KACENJAR, S. N84-22937
N84-22952
KACZMAREK, R. E. N84-22652
KAHN, J. M. N84-23286
KAMA, W. N. N84-23099
KANDO, M. N84-23264
KANGAS, J. N84-23052
N84-23053
KANNEL, J. W. N84-22960
KANTOR, A. J. N84-23076
KARASEV, A. V. N84-22777
KARLIN, B. E. N84-22552
KARNER, F. R. N84-23437
KASIRAJ, P. N84-22741
KASRAIE, K. N84-22966
KASTNER, C. J. N84-23002
KATSANIS, T. N84-22564
KAVAYA, M. J. N84-22943
KAWASHIMA, C. N84-23040
KAZAKOV, A. V. N84-22794
KEEFE, R. L. N84-22658
KEISER, H. N84-22729
KELLER, G. R. N84-23008
KELLEY, M. N84-23111
KELLEY, P. N84-23336
KELMAN, V. A. N84-22778
KELZON, A. S. N84-22902
KENNEDY, F. E., JR. N84-22961
KERNER, W. N84-23262
KERSHAW, R. P. N84-22706
KEY, J. F. N84-22940
KHAUSTOV, A. I. N84-22780
KHODDAM-MOHAMMADI, H. N84-22995
KHOROSHILOV, V. N. N84-22799
KHOROTILOV, V. N. N84-22800
KIEFER, M. A. N84-22821
KIM, M. D. N84-22530
KIMBALL-LINNE, M. A. N84-22637
KING, J. S. N84-23475
KIPP, C. W. N84-23307
KIPP, G. B. N84-23309
KIRKPATRICK, A. N84-23516
KLEIMAN, D. L. N84-22845
KLEIN, N. N84-22670
KLEINBERG, L. L. N84-22687
KLINT, P. N84-23160
KLOOSTER, L. A. N84-22659
KNEPTON, J. N84-23126
KNIGHT, D. D. N84-22916
KNOX, R. E. N84-22849
KOBAYASHI, H. S. N84-22820
KOCHEL, C. N84-23500
KODNYANKO, V. A. N84-22775
KOFEL, W. K. N84-22560
KOH, J. L. N84-23018
KOLESNIKOV, A. S. N84-23388
KOLODZIEJ, W. J. N84-23186
KOMAR, P. D. N84-23503
N84-23504
KONG, F. M. N84-22705
N84-22706
KONOVALOV, B. N84-23390
KONVALINKA, M. J. N84-23317
KOOKER, D. E. N84-22667
KOTOV, P. I. N84-22799
N84-22800
KOZAK, R. C. N84-23525
KRAMER, L. C. N84-22837
KREITZBERG, C. N84-23036
KREMENTSKIY, M. D. N84-22786
KRIEGER, J. D. N84-23310
KRILL, J. A. N84-22865
KUMAR, D. N84-22697
KUO, K. K. N84-22677
KURIEN, T. N84-22858
KURTH, W. S. N84-23545
KURTZ, G. W. N84-22928
KURZKE, H. N84-23245
KUZNETSOV, M. M. N84-22791
KUZNETSOV, S. F. N84-22800
KWAN, J. N84-23269
KYCHAKOFF, G. N84-22637

L

LACOSS, R. T. N84-22856
LAM, C. S. N84-22994
LANDON, P. N84-22964
LANDRAM, C. S. N84-22962
LANGENDORF, P. M. N84-23402
LANKELMA, J. V. N84-23214
LANZEROTTI, L. J. N84-23209
LARSON, R. D. N84-23337
LASCANO, R. N84-23006
LAUE, E. N84-23452
N84-23490
LAUER, D. T. N84-23003
LAUVER, R. W. N84-22698
N84-22699
N84-22700
N84-22701
LAUWERIER, H. A. N84-23204
N84-23205
LAVERDET, G. N84-23050
LAWSON, J. S., JR. N84-22836
LAWTON, E. A. N84-22620
LAY, P. A. N84-22723
LEBRAS, G. N84-23050
N84-23051
LEBRON, J. E. N84-22548
LECOMTE, P. B. A. N84-23175
LEE, E. U. N84-22985
LEE, J. N84-22860
LEE, M. J. N84-22690
LEE, R. E. N84-22634
LEE, S. W. N84-23486
LEE, W. I. N84-22708
LEIDHEISER, H., JR. N84-22739
LEINER, B. N84-22831
LEININGER, G. N84-23338
LEJEUNE, G. N84-23054
LEMES, M. A. M. N84-23086
LENSTRA, A. K. N84-23190
N84-23191
N84-23201
LENSTRA, J. K. N84-23216
LEROUX, G. N84-22881
LESTER, D. F. N84-23411
LEUNG, K. N. N84-23269
LEVIS, A. H. N84-22635
N84-22639
N84-22644
N84-22861
LEVY, A. J. N84-23158
LEWIN, R. N84-22942
LEWIS, D. N84-22578
LEWIS, J. H. N84-23193
LEWIS, P. J. N84-23132
LEWIS, S. W. N84-23513
LI, T. T. T. N84-22718
N84-23242
LIAO, S. S. N84-23342
LIDIAK, E. G. N84-23008
LIEBER, R. S. N84-23383
LIETZKE, A. F. N84-23269
LIGHT, R. W. N84-22953
LINK, J. N84-22810
LIPMAN, R. R. N84-22983
LIPPMANN, M. J. N84-23030
LITTLEWOOD, M. I. N84-22972
LIU, H. Y. N84-22718
N84-22723
N84-23242
LIVINGSTON, R. C. N84-23044
LO, C. A. N84-22685
LOMUNOV, V. K. N84-22798
LONGHOUSER, J. E. N84-23306
LONGHUA, Y. N84-22918
LORENZO, C. F. N84-22566
LORGE, J. D. N84-23126
LUCCHITTA, B. K. N84-23480
N84-23499
N84-23505
N84-23541
LUCEY, P. G. N84-23519
LUDOWISE, M. J. N84-23280
LUH, P. B. N84-22863
LUKKARI, L. N84-23053
LUNDSTROM, N. H. N84-22676
LURYE, B. G. N84-22774
LYMZIN, V. N. N84-22773
LYNCH, J. T. N84-22671

M

MA, M. H. N84-22864
MACFARLANE, J. J. N84-23428
MACKENZIE, J. D. N84-22753
MACKINNON, M. J. N84-23235
MACLENNAN, C. G. N84-23209
MACLEOD, H. N84-23050
MADAN, S. N84-23210
MADEY, J. M. J. N84-22949
MAGNUSSON, H. N84-23080
N84-23081
MAHIN, K. W. N84-22964
MAHOY, J. O. N84-23378
MAIN, H. A. N84-23313
MAJEWSKI, W. D. N84-23355
MALAIYA, Y. K. N84-23281
MALASSINE, M. B. N84-23225
MALGRANGE, B. N84-23172
MALIKOV, M. M. N84-22777
MALIN, M. C. N84-23501
N84-23514
MALININ, L. M. N84-22802
MALUMUTH, E. M. N84-23425
MANN, W. P. N84-23062
MANSOUR, N. N. N84-22535
MANZO, M. A. N84-22712
N84-23022
N84-23025
N84-23026
MARSH, B. D. N84-23493
MARSH, W. M. N84-23493
MARSHALL, B. A. N84-22603
MARSHALL, J. R. N84-23455
MARTIN, C. N84-23193
MARTIN, C. R. N84-22754
MARTIN, M. D. N84-23375
MARTIN, P. N84-22810
MARTINO, J. N84-22671
N84-22678
MARUYAMA, Y. N84-23269
MASURSKY, H. N84-23454

MATHES, H. B. N84-22651
MATHUR, A. B. N84-22544
MATSON, J. C. N84-22638
MATTHES, H. N84-23290
MATUK, C. A. N84-23269
MAXWELL, T. A. N84-23471
N84-23538
N84-23539
MAY, R. G. N84-22781
MAYER, J. W. N84-22694
MAZAUDIER, C., M. N84-23055
MCCANN, T. M. N84-23322
MCCARTHY, J. L. N84-22755
MCCARTY, K. P. N84-22658
MCCAULEY, J. F. N84-23511
MCCHRYSTAL, D. L. N84-23352
MCCORD, T. B. N84-23519
MCCOWAN, W. L. N84-23185
MCCOY, D. G. N84-22666
MCCULLOUGH, R. W. N84-22624
N84-22627
MCELIECE, B. N84-22827
MCEVILY, A. J. N84-22738
MCEWAN, A. S. N84-23522
MCEWEN, A. S. N84-23446
MCEWEN, R. S. N84-23249
MCGARRY, F. N84-23136
N84-23150
MCGILL, G. E. N84-23457
MCGILLEM, C. D. N84-23107
MCGOVERN, W. M. N84-23340
MCHONE, J. N84-23526
MCILWAIN, M. E. N84-22940
MCINTIRE, D. N84-23520
MCISAAC, J. P. N84-22599
MCKENZIE, D. L. N84-23548
MCKINNEY, B. J. N84-23339
MCLAUGHLIN, L. K. N84-23293
MCLEAN, E. A. N84-22947
N84-22952
MCLEOD, R. G. N84-23004
MCNEIL, W. J. N84-22616
MCNICHOLS, G. R. N84-23339
N84-23343
MEDFORD, L. V. N84-23209
MEERTENS, L. N84-23200
MEETHAM, G. W. N84-22742
MEHALIC, C. M. N84-22566
MEHTA, S. N84-22890
MEINERS, A. C., JR. N84-23372
MEISLING, K. E. N84-23061
MEISSNER, H. G. N84-23159
MELLIN, P. J. N84-22659
MELONI, A. N84-23209
MENGELKAMP, H. T. N84-23035
MENGELKEMP, H. T. N84-23082
MENOLD, R. N84-22729
MENZIES, R. T. N84-22943
MERCER, G. N84-22549
MERRIMAN, M. P. N84-22637
MERRIMAN, T. L. N84-22960
MESSIER, R. N84-23120
METZER, D. W. N84-22659
MICCI, M. M. N84-22649
MICHIE, P. R. N84-23131
MIKADO, T. N84-23277
MILLARD, G. H. N84-22819
MILLER, C. D. N84-22609
MILLER, J. G. N84-22969
MILLER, T. B. N84-23023
MILSHTEIN, T. N84-22688
N84-22715
MINOTT, P. O. N84-23248
MISHRA, I. B. N84-22655
MITCHELL, R. N84-23404
MITYAKOV, V. Y. N84-22787
MIYAMOTO, N. N84-23229
MOEHRING, W. N84-23239
MOHLER, R. R. N84-23186
N84-23237
MOLES, C. N84-22549
MOMENT, R. L. N84-23033
MOON, K. J. N84-22647
MOORE, H. J. N84-23487
MOORE, J. G. N84-23044
MOORE, J. S. N84-22768
MOORE, M. L. N84-22676
MOORE, R. L. N84-22705
MOORE, T. D. N84-22650
MOOSE, P. H. N84-22838
MORAN, C. M. N84-22620
MORFILL, G. E. N84-23547
MORGAN, D. M. N84-23351
MORGAN, P. D. N84-22843
MORGAN, R. J. N84-22705
N84-22706
MORI, S. N84-22857
MORRIS, A. S. N84-22811
MORRIS, E. C. N84-23535
MORRIS, S. J., JR. N84-22553
MORRISON, D. N84-23440
MORTENSEN, J. K. N84-23060
MOSHER, J. A. N84-23521
MOSSE, A. L. N84-22788
MOTTMANN, J. N84-23550
MOUGINIS-MARK, P. J. N84-23443
N84-23481
N84-23530
N84-23534
MOURA, A. D. N84-23072
MUCKLOW, P. A. N84-22570
MUELLER, D. N84-23179
MUELLER, G. N84-22729
MURAVITSKIY, M. A. N84-22776
MURPHY, J. D. N84-22913
MURPHY, R. L. N84-23328
MYERS, M. G. N84-23317
MYRA, J. R. N84-23273

N

NACOZY, P. E. N84-22598
NAGLE-ESHLEMAN, J. N84-22976
NAKAMURA, T. M. N84-23231
NAKANISHI, S. N84-22631
NATIONS, H. L. N84-23410
NAVA, D. F. N84-23430
NCIRI, B. N84-23291
NELMS, W. P. N84-22532
N84-22536
NEMCHINOV, I. V. N84-22795
NESTERENKO, V. P. N84-22803
NETZER, D. W. N84-22686
N84-22715
NEURGAONKAR, R. R. N84-23278
NEWLEY, R. A. N84-22743
NEWMAN, B. A. N84-22760
NEWMAN, E. M. N84-22875
NEWMAN, J. C., JR. N84-22979
NEWNHAM, R. E. N84-23120
NEWTON, A. G. N84-22580
NEWTON, R. W. N84-23007
NGUYEN, N. Z. N84-22704
NICHOLL, R. A. N84-23127
NICKOLAS, G. T. N84-23296
NICOLAS, G. T. N84-23349
NIEDSTADT, R. M. N84-23274
NIKOLAS, G. T. N84-23311
NING, T. N84-22883
NISHT, M. I. N84-22784
NISKANEN, J. N84-23052
N84-23053
NOLA, F. J. N84-22885
N84-22886
NOOR, A. K. N84-22907
NORMAN, D. A. N84-23155
NORMAN, K. N84-23146
NORRIS, M. N84-23474
NORTON, M. G. N84-23376
NUMMEDAL, D. N84-23506

O

OATES, G. C. N84-22915
OBERMEIER, F. N84-23239
OBRIEN, W. F., JR. N84-22640
ODENWALDER, J. N84-22830
OLAOSEBIKAN, O. B. N84-22974
OLIVERIA, J. S. N84-23119
OLSON, M. N84-22549
OMOTOSO, M. A. N84-22965
OPPERMANN, G. N84-22729
ORLANDO, V. N84-22604
ORLOVSKIY, V. M. N84-22782
ORTEGA, J. M. N84-23255
OSATYUK, Y. N84-23389
OSBORN, J. R. N84-22654
OSGA, G. A. N84-22654
OSHAUGHNESSY, S. F. N84-23331
OSIPOV, V. V. N84-22782
OSSAKOW, S. L. N84-23043
OUKSEL, M. N84-23400
OVERINGTON, I. N84-23096
N84-23102
N84-23103
N84-23104
OWENS, D. H. N84-23166
N84-23167

P

PACANOWSKY, E. N84-22655
PADOVA, C. N84-22628
PAE, K. D. N84-22760
PAGE, J. N84-23136
N84-23150
PAILLARD, C. N84-22728
N84-22921
PALIWAL, K. C. N84-22561
PALMER, J. N84-23000
N84-23002
PAMIDIMUKKALA, K. M. N84-22629
PANKRATOVA, N. D. N84-22805
PANNANTONI, R. F. N84-23236
PANOSKO, G. Y. N84-22801
PAPELL, S. S. N84-22909
PARAMADILOK, O. N84-22993
PARIS, J. F. N84-23007
PARKER, J. A. N84-22697
N84-22745
PARMENTIER, E. M. N84-23441
PARR, D. M. N84-22657
PARR, R. G. N84-22888
PARR, T. P. N84-22657
PARRA, G. T. N84-22934
PARSONS, E. N84-23299
PARTRIDGE, M. J. N84-22528
PARVATHAM, R. N84-23177
PASS, M. N84-23032
PATEL, S. N84-22860
PATTON, P. C. N84-23515
PAUL, J. H. N84-23094
PAWLOWSKI, P. N84-22621
PEARCE, B. E. N84-22624
N84-22627
PEARSON, L. W. N84-22876
PEARTON, S. J. N84-23286
PECK, J. S. N84-23293
PEER, J. E. N84-23352
PELZ, R. B. N84-22529
PENA, T. N84-23097
PEPPER, W. B. N84-22541
PEREIRA, C. S. N84-23086
PEREIRA, S. A. N84-23133
PETERFREUND, A. R. N84-23460
N84-23481
PETERSEN, G. N84-23035
PETERSSON, R. N84-23080
N84-23081
PETRI, W. H. F. N84-22723
PETRICK, S. W. N84-22903
PETROV, M. V. N84-22798
PETTENGILL, G. N84-23461
PETTERSSON, L. N84-23080
N84-23081
PETTITT, M. R. N84-23234
PHILPOTT, M. R. N84-22721
PICKARD, A. C. N84-22575
PICKERING, H. W. N84-22713
PIERI, D. N84-23474
N84-23482
N84-23516
PIESER, W. N84-22550
PIETERS, C. M. N84-23519
PIKE, R. J. N84-23464
N84-23470
PIKKAARAINEN, T. N84-23052
PIRKUL, H. N84-23399
PKKARAINEN, T. N84-23053
PLESCIA, J. B. N84-23444
N84-23473
PLISKE, R. M. N84-23111
PLUNKETT, R. N84-22984
POGUDIN, P. N84-23389
POINSARD, P. N84-23049
POLLACK, J. B. N84-23433
N84-23488
POPOV, S. P. N84-22795
POST, R. E. N84-22734
POSTAWKO, S. E. N84-23427
POSTOLNIK, Y. S. N84-22733
POTERYAYEV, A. G. N84-22782
POULET, G. N84-23050
N84-23051
POWELL, E. S. N84-22691
POWERS, J. P. N84-22659
PRATT, B. G. N84-23380
PRESLEY, B. J. N84-23510
PRESSLEY, H. N84-22639
PREVOT, L. N84-23016
PRICE, C. F. N84-22682
PRICE, E. W. N84-22653
N84-22660
PRIDDEN, C. H. N84-22573

PRIDMAN, V. M. N84-22608
PROSNITZ, D. N84-22954
PROVINES, W. F. N84-23097
PROZAN, R. J. N84-22908
PRUESS, K. N84-23014
PRUITT, G. N84-23401
PRUNEDA, C. O. N84-22705
N84-22706
PULFORD, C. T. R. N84-22758
PURSCH, W. C. N84-23324
PUZEY, N. J. N84-23105

R

RABINOVICH, E. M. N84-22779
RADHAKRISHNAN, N. N84-22986
RAHE, A. J. N84-23097
RAJAN, N. N84-22585
RAJU, B. B. N84-22555
RAJU, I. S. N84-22979
RAMAKRISHNA, K. N84-23344
RAMARKRISHNA, K. N84-23341
RAMSEY, J. N84-23141
N84-23142
RAUPP, H. N84-23080
N84-23081
REA, E. C., JR. N84-22637
REDDY, A. S. S. R. N84-23091
REDEY, L. N84-22898
REDIESS, H. A. N84-22583
REDMON, L. T. N84-22630
REDMON, N. J. N84-22630
REED, I. N84-22834
REED, R. N84-22655
REEVES, A. D. N84-23318
REICHMAN, B. N84-23019
REID, M. A. N84-22734
REINKENHOF, J. N84-23034
RENIE, J. P. N84-22645
N84-22654
RENZ, D. D. N84-22615
REYNOLDS, L. D. N84-22940
REYNOLDS, R. T. N84-23448
REZEK, T. W. N84-22557
RHODES, D. D. N84-23517
RICCO, A. J. N84-22714
RICE, W. J. N84-22559
RICHARDS, T. L. N84-23046
RICHARDSON, J. C. N84-22689
RIEKER, L. L. N84-23023
RINNOOYKAN, A. H. G. N84-23216
RINO, C. L. N84-22873
RIPIN, B. H. N84-22947
N84-22952
RIS, V. V. N84-22787
RISTENBATT, M. N84-22825
RITTER, J. A. N84-23057
ROBBINS, F. W. N84-22663
N84-22664
ROBERSON, J. N84-22877
ROBINS, A. W. N84-22553
ROBINSON, D. N84-23379
ROBINSON, K. E. N84-22949
ROEDER, G. L. N84-23330
N84-23331
N84-23332
ROESLER, G. E. N84-23340
ROGERS, J. N84-23146
ROGERS, R. C. N84-22687
ROGERS, R. N. N84-22680
ROGO, C. N84-22568
ROHLEDER, M. N84-23136
ROMAN, N. G. N84-23418
N84-23419
N84-23420
ROMEU, J. L. N84-23149
RONE, K. Y. N84-23148
ROSE, B. N84-23329
ROSE, M. F. N84-22936
ROSECRANS, P. M. N84-22766
ROSINBERG, M. L. N84-23182
N84-23207
ROSSBACHER, L. A. N84-23507
N84-23508
ROSSER, R. W. N84-22744
ROSTOVTSEV, A. M. N84-22773
ROTH, L. E. N84-23529
ROUSSOPOULOS, N. N84-23146
ROUTH, D. E. N84-22884
ROWLETTE, J. J. N84-23020
ROY, A. K. N84-22984
ROZAS, P. N84-22820
RULE, D. W. N84-23241
RUSSEL, J. H. N84-23386
RYAN, B. C. N84-23083
RYAN, G. G. N84-22610
RYZHIK, B. V. N84-22808

S

SABERI, R. T. N84-23132
SACHELARIE, D. N84-23283
SACHELARIE, M. N84-23283
SAFRONOV, S. P. N84-22717
SAGE, A. P. N84-22651
N84-22652
SAHA, A. N84-23409
SALOMON, P. M. N84-23247
SALVAIL, J. R. N84-23451
SAMBAMURTHI, J. K. N84-22653
N84-22660
SAMPATH, P. N84-22769
SANCHEZ, R. J. N84-22704
SANDELL, R. S. N84-22618
SANDS, T. N84-23267
SARGESON, A. M. N84-22723
SASTRY, V. V. S. S. N84-23046
SATYANARAYANA, P. N84-23043
SAUNDERS, R. S. N84-23490
SAUNDERS, S. N84-23452
SAVAGE, R. K. N84-23002
SAVOLAINE, C. G. N84-23144
SAYLOR, W. J. N84-23121
SCAGLIONE, L. J. N84-23026
SCARF, F. L. N84-23039
N84-23545
SCHABER, G. G. N84-23454
N84-23525
N84-23532
N84-23533
SCHADOW, K. C. N84-22690
SCHALL, P. N84-22897
N84-22962
SCHARSCHMIDT, J. N84-22729
SCHEINBEIM, J. I. N84-22760
SCHERER, W. T. N84-22852
SCHIPPNICK, P. F. N84-22629
SCHLACTER, A. S. N84-23243
SCHLEGEL, E. M. N84-23408
SCHMIDT, J. F. N84-22533
SCHMITT, A. J. N84-22951
SCHNEIDER, E. N84-23550
SCHOFIELD, N., JR. N84-23418
SCHOLTZ, R. A. N84-22821
SCHOWENGERDT, R. A. N84-23254
SCHRADER, A. M. N84-23405
SCHRAUF, G. N84-22925
SCHROEDER, J. E. N84-22748
SCHROEDER, T. F. N84-22963
SCHULTZ, D. F. N84-22958
SCHULZ, G. N84-22588
SCHUMACHER, J. C. N84-23059
SCHUTT, H. J. N84-23370
SCHUTZER, D. N84-22855
SCHWARTZ, A. N84-22549
SCHWARTZ, S. C. N84-23183
SCHWARZ, R. B. N84-22741
SCHWARZE, G. E. N84-22892
SCHWETTMAN, H. A. N84-23285
SCOPELIANOS, A. G. N84-22750
SCOTT, B. N84-22848
SCOTT, D. H. N84-23536
N84-23537
SEE, R. M. N84-23307
SEEHUSEN, H. J. N84-23133
SEKIYA, R. N84-23231
SEMENIUK, A. N84-23478
SEN, A. N84-22726
SENNOTT, J. W. N84-22546
SERFATY, D. N84-22845
SEVESTRE, C. N84-22589
SHACKELFORD, S. A. N84-22680
SHARBER, J. R. N84-23044
SHARMA, G. C. N84-22884
SHARPTON, V. S. N84-23461
SHATOKHIN, S. N. N84-22775
SHATZ, S. M. N84-23163
SHAW, R. C. N84-22596
SHEFFIELD, J. N84-23272
SHENHAR, J. N84-22617
SHERIDAN, M. F. N84-23483
SHESHADRI, T. S. N84-22660
SHIGEI, Y. N84-23231
SHINGLETON, J. N84-22768
SHLICHTA, P. J. N84-22748
SHNEIDERMAN, B. N84-23146
SHOEMAKER, E. M. N84-23445
N84-23465
SHORES, P. W. N84-22820
SHOUP, J. N84-22877
SHUKHOLUTSKIY, Y. A. N84-22774
SIDMAN, K. R. N84-23113
SIEBER, M. N84-23015
SIGMAN, R. K. N84-22680
SILVERBERG, L. M. N84-22618
SILVESTER, J. N84-22821
SIMPSON, R. A. N84-23528
SIPPEL, R. N84-23080
N84-23081
SISTERSON, D. L. N84-23077
SJOEGREN, P. N84-23210
SKLIZKOV, G. V. N84-22781
SKOVORODKO, S. N. N84-22777
SLACK, M. N84-22623
SLATER, P. N84-23000
SLATER, P. N. N84-23002
SMILOWITZ, K. N84-23247
SMITH, C. R. N84-22917
SMITH, J. M. N84-22565
N84-22567
SMITH, M. J. T. N84-23037
SMITH, S. R. N84-22602
SMITHRICK, J. J. N84-23025
SMYLY, H. M. N84-22609
N84-22912
SMYTH, J. R. N84-22759
SNAPE, D. M. N84-22582
SODERBLOM, L. A. N84-23448
N84-23521
N84-23522
N84-23523
SOFFER, B. H. N84-23256
SOHN, J. L. N84-22647
SOIFER, B. T. N84-23413
N84-23414
SOLODUKHO, F. M. N84-22807
SOLOMON, S. C. N84-23458
N84-23534
SOLTIS, D. G. N84-22734
SOMERS, I. A. N84-23333
SOMERVILLE, P. N. N84-23206
N84-23208
SOMMERJER, B. P. N84-23195
SORRELL, G. L. N84-23343
SOULSBY, E. P. N84-22845
SPADONI, D. J. N84-22590
SPAEPEN, F. N84-22752
SPANG, S. T. N84-22899
SPENCER, J. R. N84-23518
SPENCER, N. A. N84-22548
SPRAFKA, R. J. N84-22766
SPUDIS, P. D. N84-23463
N84-23464
SQUYRES, S. W. N84-23448
N84-23472
SRI-JAYANTHA, M. N84-22542
SRULL, D. W. N84-23354
ST.CLAIR, T. L. N84-22746
N84-22749
STABILE, D. A. N84-22861
STACH, J. R. N84-22893
STAM, M. N84-23468
STAMPER, J. A. N84-22947
N84-22952
STAPLES, J. N84-23271
STARK, R. M. N84-23345
STAROVIT, V. V. N84-23388
STEFANSSON, V. N84-23014
STEIN, W. A. N84-23413
N84-23414
STENGER, G. J. N84-22988
STEPHENS, E. N84-23490
STEPHENS, J. N84-23452
STERMAN, A. P. N84-22560
STERN, D. P. N84-23041
STEVENSON, J. N84-22558
STIEF, L. J. N84-23430
STOBIE, I. C. N84-22684
STOCKWELL, R. D. N84-22960
STOREY, J. W. V. N84-23411
STORP, S. N84-22729
STOUGIE, L. N84-23216
STOWERS, I. N84-22964
STRAHLE, W. C. N84-22642
N84-22689
STRAYER, B. D. N84-23545
STRICKLAND, R. N. N84-23254
STROBELL, M. E. N84-23532
N84-23533
STROM, R. G. N84-23436
N84-23462
N84-23544
SU, S. Y. H. N84-23281
SUEMITSU, M. N84-23229
SUGAI, H. N84-23264
SUKRI, J. N84-23140

SULLIVAN, P. D. N84-23314
SUNDBERG, G. R. N84-22891
SUTTON, S. N84-23452
N84-23490
SUVOROV, Y. V. N84-22780
SWABY, H. P. N84-22904
SWAIN, B. N84-23156
SWAMINATHAN, S. N84-22543
SWANK, R. P. N84-23302
SWANSON, D. H. N84-23319
SWANSON, E. E. N84-22553
SWARTZ, C. K. N84-22600
SWEENEY, J. L. N84-23327
SWEENEY, P. J. N84-23312
SYLVAIN, M. N84-22881
SZENTIRMAY, M. N. N84-22754

T

TACONET, O. N84-23016
TADAYYONI, M. A. N84-22719
TAIEB, C. N84-23049
TAKEUCHI, M. N84-23230
TALLANT, D. R. N84-22953
TANG, Z. N84-23186
TATOM, F. B. N84-22602
TATTELMAN, P. N84-23076
TAUTZ, M. F. N84-22616
TAVENDALE, A. J. N84-23286
TAYLOR, R. E. N84-22546
TEE, K. N84-22857
TELESMAN, J. N84-22735
TEMPS, F. N84-22730
TENEKETZIS, D. N84-22862
TENNEY, R. R. N84-22835
N84-22859
TERRILE, R. J. N84-23447
THEEDE, E. N84-23364
THEILIG, E. N84-23479
N84-23484
THIELEN, G. J. N84-23365
THOMAS, D. M. N84-23315
THOMAS, F. H. N84-22971
N84-22972
THOMAS, J. B. N84-22872
THOMAS, P. N84-23489
THOMAS, V. N84-23098
THOMAS, W. J. R. N84-22581
THOMPSON, R. N84-23100
THOMPSON, T. W. N84-23531
THONY, J. L. N84-23016
THORISSON, H. N84-23218
THORNDYKE, P. W. N84-23109
THORPE, R. D. N84-22627
TIERNEY, J. N84-22871
TIFFON, J. N84-22879
N84-22880
TILDEN, S. B. N84-22710
TIRPAK, J. D. N84-22740
TISCHER, K. N84-22550
TISON, R. R. N84-22768
TITMUSS, G. E. N84-23070
TIURYN, J. N84-23219
TKACHEVA, L. A. N84-22793
TOBIAS, R. H. N84-22757
TOKUDA, A. R. N84-23257
TOLLER, D. F. N84-22813
N84-22956
TOWILL, B. P. N84-22743
TOWNES, C. H. N84-23411
TRAPP, D. L. N84-23346
TREDICI, T. J. N84-23097
TRIANTAFYLLOU, M. S. N84-22978
TRIMECHE, K. N84-23180
TRIPICCO, M. N84-23440
TROEGER, R. E. N84-22560
TROLINGER, J. D. N84-22940
TSAI, W. K. N84-23154
TSCHOEGL, N. W. N84-22765
TUBBING, B. J. D. N84-22941
TUCHIN, V. V. N84-22779
TUGAZAKOV, R. Y. N84-22790
TULEY, E. N. N84-22560
TUMIN, A. M. N84-22792
TURNER, F. N84-22814
TURNER, R. N84-22634
TUXWORTH, R. W. N84-23261
TWOHIG, L. G. N84-22976
TYGIELSKI, P. J. N84-22912
TYLER, G. L. N84-23528

U

UGODCHIKOV, A. G. N84-22798

V

VAIDYA, D. B. N84-22629
VALDES, P. M. N84-23143
VALE, L. N84-23520
VALUYEV, A. D. N84-22781
VANBAVEL, C. H. M. N84-23006
VANDEKIEFT, L. N84-22655
VANDENBULCKE, L. N84-22707
N84-23291
VANDERHOUWEN, P. J. N84-23195
VANDERPUT, M. N84-23174
VANDOORN, E. A. N84-23192
N84-23211
N84-23217
N84-23220
VANECHO, J. A. N84-22960
VANGILS, S. A. N84-23223
VANHOOF, H. A. J. M. N84-23238
VANROY, B. H. N84-23289
VARMA, I. K. N84-22745
VARNEY, A. M. N84-22671
N84-22678
VARSHAVSKIY, A. Y. N84-23395
VASILENKO, A. T. N84-22805
VASIN, B. L. N84-22781
VATSA, V. N. N84-22537
VELGHE, M. F. N84-22949
VERTER, F. A. N84-23424
VERTREES, J. N84-23366
VEVERKA, J. N84-23438
N84-23439
VIDAL-MADJAR, D. N84-23016
VINAREK, J. N84-23221
VINNINS, M. F. N84-22547
VISSERS, D. N84-22898
VITANYI, P. M. B. N84-23161
N84-23200
N84-23202
N84-23203
VLADIMIROFF, T. N84-22674
VLZHIYEVSKAYA, O. V. N84-22804
VONFRESE, R. R. B. N84-23008
VOVELLE, C. N84-22727
VREELAND, T., JR. N84-22741

W

WAGNER, H. G. N84-23245
WAGNER, R. N84-23080
N84-23081
WALES, H. M. N84-23302
WALKER, P. H. N84-22573
WALKLEY, K. B. N84-22553
WALTERICK, R. E. N84-22689
WANG, H. M. N84-22812
N84-22817
WANG, J. J. H. N84-22669
WANG, T. G. N84-23233
WARD, J. R. N84-23157
WARREN, E. L. N84-22959
WARREN, W. H., JR. N84-23415
N84-23416
N84-23417
N84-23418
N84-23419
N84-23420
N84-23421
WASHBURN, J. N84-23287
WASHBURN, R. N84-22858
WATERS, W. J. N84-22930
WATSON, D. M. N84-23411
N84-23423
WATTERS, E. R. N84-23313
WATTERS, T. R. N84-23538
N84-23539
WEAVER, M. J. N84-22716
N84-22718
N84-22719
N84-22720
N84-22721
N84-22722
N84-22724
N84-22725
N84-23242
N84-23284
WEBER, C. L. N84-22821
WEBER, E. J. N84-23044
WEBSTER, R. N84-23404
WEIDNER, E. H. N84-22687
WEINBERG, I. N84-22890
WEISS, J. L. N84-22859
WEIZER, V. G. N84-23027
WELLS, I. D. N84-23018
WERKING, R. N84-23150
WERNER, C. N84-22955
WERNER, M. N84-23411
WESCOURT, K. T. N84-23109
WEST, B. S. N84-22988
WESTERGREN, B. N84-23213
WESTLAKE, D. G. N84-23288
WESTON, A. R. N84-22638
WESTPHAL, M. N84-23080
N84-23081
WHINERY, L. D. N84-22541
WHIPPLE, F. L. N84-23450
N84-23543
WHITE, C. C., III N84-22851
N84-22852
WHITE, H. S. N84-22714
WHITE, K. J. N84-22666
WHITFORD-STARK, J. L. N84-23443
WHITTAKER, A. N84-22950
WHITTIER, J. S. N84-22950
WICKENS, C. D. N84-22848
WILHELMS, D. E. N84-23472
WILLIAMS, R. B. N84-22526
WILLIAMS, R. F. N84-23303
WILLIAMS, R. M. N84-23020
WILLIAMS, S. N84-23492
WILLNER, S. P. N84-23413
WILLOUGHBY, P. C. N84-22643
WILLSKY, A. N84-22858
WILNER, S. P. N84-23414
WILSON, J. R. N84-22649
WILSON, L. N84-23441
WILSON, M. E. N84-23325
WINDINGLAND, L. M. N84-23029
WISANDER, D. W. N84-22957
WISE, D. U. N84-23540
WITBECK, N. E. N84-23537
WITHEROW, W. K. N84-22929
WITTE, A. B. N84-22635
WOHL, J. G. N84-22846
WOHLETZ, K. H. N84-23483
WOLF, S. W. D. N84-22534
WOLFE, A. N84-23209
WOLFE, J. F. N84-22746
WOLFE, R. F. N84-23445
WOLFF, T. H. N84-23178
WOMER, N. K. N84-23334
WONG, T. H. N84-22991
WOOD, C. A. N84-23485
WOOD, H. L. N84-22640
WOODALL, D. M. N84-23268
WOODRUFF, C. D. N84-23316
WOODWARD, R. P. N84-23235
WORM, G. N84-23335
WORTHLEY, J. P. N84-22668
WOZENCRAFT, J. M. N84-22838
WRIGHTON, M. S. N84-22714
WU, E. M. N84-22704
WURSTER, W. H. N84-22628
WYDERSKI, M. T. N84-22763

X

XINTIAN, Y. N84-22918

Y

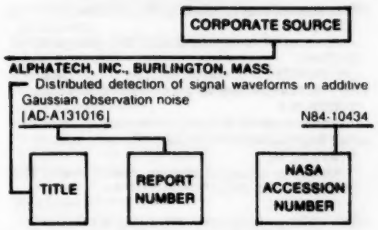
YABLONIK, R. M. N84-22786
YAMANOUCHI, K. N84-23230
YANG, L. C. N84-22935
YANG, V. N84-22686
YEAGER, E. B. N84-22755
YEH, E. N. N84-23056
YERMOLAYEVA, Y. M. N84-22788
YOUNG, M. J. N84-23108
YOUNG, P. H. N84-22579
YOUNG, V. N84-23404
YU, S. N84-22677

Z

ZABEL, W. V. N84-23376
ZABRODIN, V. K. N84-22786
ZALESAK, S. T. N84-23047
ZAMPARELLI, S. J. N84-23320
ZAPESOCHNYY, I. P. N84-22778
ZAPLATYNSKY, I. N84-22944
ZEIDNER, L. E. N84-23166
ZEITLIN, A. D. N84-22548
ZELKOWITZ, M. N84-23138
ZELKOWITZ, M. V. N84-23140
ZEMAN, G. H. N84-23240
ZERWEKH, P. S. N84-22932
ZHOU, B. M. N84-22816

ZIMBELMAN, J. R. N84-23524
ZINK, B. T. N84-22646
ZISK, S. A. N84-23460
N84-23461
ZISK, S. H. N84-23530
ZOBRIST, A. L. N84-23004
ZUBER, M. T. N84-23459
ZUCKER, J. I. N84-23199
ZUCKERWAR, A. J. N84-22933

Typical Corporate Source Index Listing



Listings in this index are arranged alphabetically by corporate source. The title of the document provides the user with a brief description of the subject matter. The report number helps to indicate the type of document cited (e.g., NASA report, translation, NASA contractor report). The NASA accession number denotes the number by which the citation is identified. The titles are arranged under each corporate source in ascending accession number order.

A

ABERDEEN PROVING GROUND, MD.
Status of ammonium nitrate in propellants and explosives N84-22655

ACADEMY OF SCIENCES (USSR), MOSCOW.
Scientific activity in hydrology, 1979-1982 N84-23010
Scientific activity in oceanography, 1979-1982 N84-23084

ADAPTIVE SENSORS, INC., SANTA MONICA, CALIF.
Sidelobe cancelling techniques used in wideband systems N84-22822
Generalized adaptive node concept N84-22833

ADVANCED INFORMATION AND DECISION SYSTEMS, MOUNTAIN VIEW, CALIF.
Distributed estimation systems
[AD-P002898] N84-22857

ADVANCED TECHNOLOGY, INC., ARLINGTON, VA.
Economic production rate study
[AD-P002793] N84-23340
Improving the effectiveness of award fee contracts for program management support services
[AD-P002827] N84-23372

AERONAUTICAL RESEARCH ASSOCIATES OF PRINCETON, INC., N. J.
Exhaust plume induced fluctuations in the index of refraction at optical wavelengths N84-22624
Aircraft exhaust plume signature predictions for non-axisymmetric multiple engine installations N84-22627

AERONAUTICAL SYSTEMS DIV., WRIGHT-PATTERSON AFB, OHIO.
Assessing contracting workforce requirements in the matrixed organization
[AD-P002760] N84-23307
The avionics integrity program (AVIP)
[AD-P002817] N84-23362
A quality improvement strategy for systems acquisition
[AD-P002820] N84-23365
Engine product performance agreements and the future
[AD-P002821] N84-23366
The Score technique: An analytical approach for assessing the results of manufacturing reviews
[AD-P002838] N84-23383

AEROSPACE CORP., EL SEGUNDO, CALIF.
Three-dimensional, two-phase supersonic nozzle flows
[AD-A138649] N84-22538
Environmental qualification tests, signal conditioning unit, SD602 materials experiment
[AD-A138910] N84-22697
Pulsed D2-F2 chain-laser damage to coated window and mirror components
[AD-A138911] N84-22950
Certification vibration tests, SD602 materials experiment
[AD-A138547] N84-22982
On the rate of energy input in thermal solar flares
[AD-A138345] N84-23548
Quenchings and outbursts of extragalactic radio sources: Nine years of 3.3-mm measurements and comparisons with centimeter-wave variations
[AD-A138233] N84-23550

AEROSPACE MEDICAL RESEARCH LABS., WRIGHT-PATTERSON AFB, OHIO.
The effect of haze on an operator's visual field and his target detection performance
[AD-A138330] N84-23099
Effects of a negative G strap on restraint dynamics and human impact response
[AD-A138642] N84-23121

AIR FORCE ACADEMY, COLO.
Research into the thermal decomposition of selected energetic material candidates (Project order ATL-2-094)
[AD-A138730] N84-22770

AIR FORCE ARMAMENT LAB., EGLIN AFB, FLA.
Contracting initiative: Best proposal for price
[AD-P002782] N84-23329
Two-step industrial preparedness planning: Balancing funds and production capability
[AD-P002802] N84-23348

AIR FORCE BUSINESS RESEARCH MANAGEMENT CENTER, WRIGHT-PATTERSON AFB, OHIO.
Proceedings of the Federal Acquisition Research Symposium with Theme: Government, Industry and Academe: Synergism for Acquisition Improvement
[AD-A137700] N84-23293
DECISION TECHNOLOGY: The catalyst for acquisition improvement
[AD-P002755] N84-23302
Cost accounting standards: A time for government and industry action
[AD-P002767] N84-23314
Needed help for the Federal Acquisition Regulation Council
[AD-P002769] N84-23316

AIR FORCE CONTRACT MANAGEMENT DIV., KIRTLAND AFB, N. MEX.
Material handling: A target for productivity improvement
[AD-P002829] N84-23374

AIR FORCE GEOPHYSICS LAB., HANSCOM AFB, MASS.
A new satellite instrument for yaw and pitch measurements
[AD-A138729] N84-22599
F-layer ionization patches in the polar cap
[AD-A138633] N84-23044
Observations of major stratospheric chlorine species
[AD-A138646] N84-23045
Handbook of geophysics and space environments, Chapter 15, 1983 revision: Atmospheric temperature, density and pressure
[AD-A138846] N84-23076

AIR FORCE INST. OF TECH., WRIGHT-PATTERSON AFB, OHIO.
Target super-resolution compensation for coherent airborne radar utilizing spread spectrum waveforms
[AD-A138545] N84-22866
The development and fabrication of an implantable, multiplexed, semiconductor multielectrode array
[AD-A138788] N84-22895
Competitive procurements: The synergistic linkage among government, industry and academe
[AD-P002773] N84-23320
Nailing down the liability issue once and for all
[AD-P002777] N84-23324
Cost risk and contract type: A normative model
[AD-P002781] N84-23328
Large firm efficiency, concentration, and profitability in defense markets
[AD-P002810] N84-23356
Contractor fraud: Government response
[AD-P002833] N84-23378
Publication in professional journals in science and engineering: A survey of editorial procedures and opinion
[AD-A138913] N84-23385

AIR FORCE LOGISTICS COMMAND, WRIGHT-PATTERSON AFB, OHIO.
Quality assurance - Air Force Logistics Command
[AD-P002816] N84-23361

AIR FORCE PACKAGING EVALUATION AGENCY, WRIGHT-PATTERSON AFB, OHIO.
Evaluation of 'Sorbothane' cushioning material
[AD-A139079] N84-22763

AIR FORCE ROCKET PROPULSION LAB., EDWARDS AFB, CALIF.
Deuterium isotope effects in HMX thermochemical mechanisms: Decomposition, deflagration, and combustion N84-22680

AIR FORCE SPACE DIV., LOS ANGELES, CALIF.
Office automation in the acquisition environment
[AD-P002747] N84-23294
The microcomputer in the acquisition environment
[AD-P002748] N84-23295
Closing the gap between R and D and application in academe to better support government and industry
[AD-P002761] N84-23308
Prerequisites for the establishment of a professional acquisition workforce
[AD-P002763] N84-23310

AIR FORCE SYSTEMS COMMAND, BOLLING AFB, WASHINGTON, D.C.
Air Force Systems Command research planning guide (research objectives)
[AD-A138851] N84-23384

AIR FORCE SYSTEMS COMMAND, WRIGHT-PATTERSON AFB, OHIO.
Vortex motion in a precombustion chamber with intersecting jets
[AD-A139040] N84-22717
The calculation of the heat transfer associated with the injection of methane gas at the stagnation point of the dissociated boundary layer of the laminar air flow
[AD-A139063] N84-22918
Transient processes in an inductor system consisting of a flat coil and a multilayer conducting medium
[AD-A139053] N84-23232
Technology of the radiation hardened MOS devices
[AD-A138995] N84-23283
Mechanized contract document preparation and abstract system
[AD-P002750] N84-23297
The acquisition management information system: Friend or foe?
[AD-P002751] N84-23298
Managing program risk: One way to reduce cost growth
[AD-P002754] N84-23301
Competition: An integral part of the acquisition process
[AD-P002774] N84-23321

AIR FORCE WEAPONS LAB., KIRTLAND AFB, N. MEX.
Discrete charge diagnostics on Pre-DIRECT COURSE
[AD-A139073] N84-22919

AIR FORCE WRIGHT AERONAUTICAL LABS., WRIGHT-PATTERSON AFB, OHIO.
Revision of design values for 7075-T7351 and 7075-T7651 aluminum plate
[AD-A139092] N84-22740

AIRCRAFT RESEARCH ASSOCIATION LTD., BEDFORD (ENGLAND).
Civil turbofan propulsion system integration studies using powered testing techniques at ARA, Bedford
[ARA-MEMO-246] N84-22561

AKRON UNIV., OHIO.
Effect of interfacial bonding on the strength of adhesion of elastomers. 3: Interlinking by molecular entanglements
[AD-A138760] N84-22757
Micromechanics of fracture in elastomers
[AD-A138783] N84-22758
Finite element analysis of structure subjected to nonstationary load fields with contact interfaces N84-22993

ALABAMA UNIV., HUNTSVILLE.
Three-dimensional vorticity procedure interactions in combustion instability analysis of solid propellant rocket motors N84-22647
ALPHATECH, INC., BURLINGTON, MASS.
A comparison of two air defense command and control models
[AD-P002876] N84-22837
Individual differences in military decisionmaking: The classification performance of active sonar operators
[AD-P002885] N84-22846
Optimal maneuver detection and estimation in multiobject tracking
[AD-P002899] N84-22858
A framework for evaluation of surveillance algorithms
[AD-P002901] N84-22859
Informational aspects of a class of subjective games of incomplete information
[AD-P002910] N84-22862
AMERICAN INST. FOR RESEARCH, BEDFORD, MASS.
Computer Aided Source Selection (CASS)
[AD-P002785] N84-23332
AMERICAN UNIV., WASHINGTON, D. C.
Clarification of environmental effects in stress corrosion cracking
[AD-A136581] N84-22737
ANALYTICS, INC., DAYTON, OHIO.
Increasing spares competition in AFLC (Air Force Logistics Center)
[AD-P002775] N84-23322
APPLIED COMBUSTION TECHNOLOGY, INC., ORLANDO, FLA.
Expended ignition effectiveness tests of selected igniter materials with Navy propellants N84-22671
Ignitibility studies of LOVA propellants N84-22678
APPLIED PHYSICS LAB., JOHNS HOPKINS UNIV., LAUREL, MD.
The 14th JANNAF Plume Technology Meeting, volume 1
[AD-A139654] N84-22619
The 20th JANNAF Combustion Meeting, volume 1
[AD-A138033] N84-22632
Particle sizing in a fuel rich airbreathing engine combustor N84-22634
Calculation procedures for variational, Born and exact solutions for electromagnetic scattering from two randomly separated dielectric Rayleigh cylinders
[AD-A136543] N84-22665
ARGONNE NATIONAL LAB., ILL.
Resistance characterization of nickel sulfide electrodes in LiCl-containing molten salt electrolytes
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Ridges on basalt flows N84-23484
Velocities of windblown particles in saltation: Venus, Earth, and Mars N84-23491
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Planetary geomorphology field studies: Iceland and Antarctica N84-23514
Thermal infrared analysis of volcanic surfaces: Mars and Hawaii N84-23524
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In-flight absolute radiometric calibration of the Thematic Mapper N84-23002
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[AD-A136736] N84-23254
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Liquid propellant ignition studies N84-22670
Convective heating of energetic materials N84-22672
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[NASA-CR-173422] N84-22788

EDGERTON, GERMESHAUSEN AND GRIER, INC., IDAHO FALLS, IDAHO.
Development of holographic interferometry for welding arc analysis
[DE84-005454] N84-22940

ELECTROTECHNICAL LAB., IBARAKI (JAPAN).
Energy loss of 24.8-MeV electrons by interacting with thick layers of C, Al, Cu, and Pb
[ETL-836] N84-23277

ELLIOTT-AUTOMATION SPACE AND ADVANCED MILITARY SYSTEMS LTD., CAMBERLEY (ENGLAND).
Human factors aspects of C3 systems
[PP-119] N84-23115

ENGINEERING ANALYSIS, INC., HUNTSVILLE, ALA.
Atmospheric turbulence simulation for Shuttle orbiter
[NASA-CR-171013] N84-22602

ERA LTD., LEATHERHEAD (ENGLAND).
An assessment of the reliability of edge connectors
[ERA-82-22] N84-22888
Thermal endurance of silicone/glass sleeving by the cyclic electrical proof test method of IEC 216 (first report)
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Thermal endurance of silicone/glass sleeving by the cyclic electrical proof test method of ICC 216 (second report)
[ERA-82-136] N84-22968

ERASMUS UNIV., ROTTERDAM (NETHERLANDS).
Symmetric systems with semisimple structure algebra: The quaternionic case
[NASA-CR-173421] N84-23193

EROS DATA CENTER, SIOUX FALLS, S. DAK.
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[E84-10100] N84-23003

EUROPEAN SPACE AGENCY, PARIS (FRANCE).
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[ESA-TT-800] N84-22588
Airborne lidar for oceanography and hydrology (FLOH)
[ESA-TT-799] N84-22955
Thermodynamic model for a central receiver of a solar plant with partial shading of the heliostat field
[ESA-TT-807] N84-23034

F

FEDERAL AVIATION ADMINISTRATION, WASHINGTON, D.C.
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[AD-A138759] N84-22549

FLORIDA UNIV., GAINESVILLE.
Ultraviolet OH emissions in H2-air diffusion flames N84-22629

FOM-INSTITUUT VOOR PLASMAFYSICA, JUTPHAAS (NETHERLANDS).
An absolute calibration method for electron cyclotron emission spectrometers
[REPT-83-149] N84-22941
Electron Cyclotron Emission (ECE) measurements on the TORTUR 3 Tokamak
[REPT-83-148] N84-23274
FOURIER INST., GRENOBLE (FRANCE).
On a fundamental inequality and the singularities of an analytic function defined by the LC-Dirichletian element
N84-23177

G

GARRETT TURBINE ENGINE CO., PHOENIX, ARIZ.
Contact-stress analysis of elastic-viscoelastic interface conditions
[AD-A138834] N84-22759
GENERAL ELECTRIC CO., BURLINGTON, VT.
Neutron radiographic study of liquid propellant combustion N84-22669
GENERAL ELECTRIC CO., CINCINNATI, OHIO.
Tip cap for a rotor blade
[NASA-CASE-LEW-13654-1] N84-22560
GENERAL ELECTRIC CO., PHILADELPHIA, PA.
Design and development of a hybrid tracker point focus fresnel passively cooled concentrator photovoltaic array
[DE84-006365] N84-23031
GEO-CENTERS, INC., NEWTON, MASS.
Use of a polyacetylene cathode in primary lithium-thionyl chloride cells
[AD-A138791] N84-22896
GEOLOGICAL SURVEY, FLAGSTAFF, ARIZ.
Evolution of the Uranus-Neptune planetesimal swarm: Consequences for the Earth N84-23445
High-resolution color images of Io N84-23446
Characterization of surficial geologic units on Venus from Pioneer Venus radar data: A progress report
N84-23454
Mercury: New identification of ancient multi-ring basins and implications for geologic evolution N84-23483
Impact of Upheaval Dome, Utah N84-23485
Volcanism in the Valles Marineris N84-23480
Dark streaks on talus slopes, Mars N84-23499
Small-scale polygons on Mars N84-23505
Multiprocess evolution of landforms in the Kharga Region, Egypt: Applications to Mars N84-23511
Multi-image photometric solutions for the Galilean satellites N84-23522
Rapid extraction of relative topography from Viking orbiter images. 2: Application to irregular topographic features N84-23523
Radar backscatter modelling N84-23525
Ancient volcano-tectonic structures of the Olympus Mons Region, Mars N84-23535
Mars paleostratigraphy N84-23536
Valles Marineris layered deposits: Implications of origin N84-23537
The Galilean Satellite Geological Mapping Program, 1983 N84-23541
GEOLOGICAL SURVEY, MENLO PARK, CALIF.
The structure of the Ionian lithosphere N84-23435
Ring spacing of Mercurian multi-ring basins and basin ring formation N84-23484
Ode to gravity: Depth/diameter for fresh craters on Mercury N84-23470
Martian dust storms witnessed by Viking Lander 1
N84-23487
Freezing of Martian streams under climatic conditions
N84-23498
GEOLOGICAL SURVEY, VANCOUVER, WASH.
The 19 March 1982 eruption and lahar at Mount Saint Helens: Implications for Martian outflow channels?
N84-23495
Drainage evolution in the debris avalanche deposits near Mount Saint Helens, Washington N84-23496
GEORGE WASHINGTON UNIV., WASHINGTON, D.C.
Energetics of vortex ring formation
[AD-A138795] N84-22539
Sedimentology and invertebrate paleontology of Triassic and Jurassic Lacustrine deposits, Culpeper Basin, northern Virginia N84-23064
GEORGIA INST. OF TECH., ATLANTA.
Rocket motor aeroacoustics N84-22642
Effect of oscillations upon velocity distributions in simulated solid propellant flow environments
N84-22646
Dependence of burning rate of AP-polymer sandwiches on thickness of the binder laminae N84-22653
Conditions for inflammation of accumulated aluminum in the propellant combustion zone N84-22660
Heterogeneous diffusion flame stabilization: Constant density results N84-22669
Computation of radiation in stratified media by Fast Fourier Transform (FFT)
[AD-A138647] N84-22669
GKSS-FORSCHUNGSZENTRUM GEESTHACHT (WEST GERMANY).
Wind energy test field Pellworm: Tests of the plant Bruemmer BW 120S
[GKSS-83-E-42] N84-23035
Meteorological investigations at the wind test site Pellworm
[GKSS-83-E-61] N84-23082
GOUGH (PAUL) ASSOCIATES, INC., PORTSMOUTH, N.H.
Continuum modeling of stick charge combustion
N84-22662
Multi-dimensional, multiphase flow analysis of flamespreading in a stick propellant charge N84-22663
GRENOBLE-1 UNIV. (FRANCE).
Annals of the Fourier Institute, volume 33, no. 4
[ISSN-0373-0956] N84-23172
GRUMMAN AEROSPACE CORP., BETHPAGE, N.Y.
Solid carbon oxidation and radiation in exhaust plumes
N84-22623

H

HANSEN (R. C.), INC., TARZANA, CALIF.
Focal region characteristics of focused microwave array antennas
[AD-A138557] N84-22867
HARVARD UNIV., CAMBRIDGE, MASS.
Bulk formation of metallic glasses and amorphous silicon from the melt
[NASA-CR-171012] N84-22752
HAWAII INST. OF GEOPHYSICS, HONOLULU.
New models for landform evolution on Io N84-23443
A generalized behavioral model for rotating short period comets with spectral orbital elements and axial orientation N84-23451
Recent comet impacts on the moon: The evidence from spectral reflectance studies N84-23453
HAWAII UNIV., HONOLULU.
Voyager feature-fixed photometry of Iapetus
N84-23440
Volcanism in Elysium Planitia, Mars N84-23481
Surface compositions in the Aristarchus Region: Implications for regional stratigraphy N84-23519
Hypsometric studies of Mars. N84-23530
HAZELTINE CORP., GREENLAWN, N. Y.
Study and design of a cylindrical lens array antenna for wideband electronic scanning
[AD-A138808] N84-22875
HERCULES, INC., MAGNA, UTAH.
A summary of the mechanisms of delayed detonation
N84-22658
HOCHSCHULE DER BUNDESWEHR, MUNICH. (WEST GERMANY).
Control of dynamic systems based on graphic information N84-23159
HONEYWELL, INC., MINNEAPOLIS, MINN.
Fine line electromigration. The effect of crossed thermal gradients
[AD-A138854] N84-23279
HOWARD UNIV., WASHINGTON, D. C.
Navigation system and method
[NASA-CASE-GSC-12508-1] N84-22546
Attitude and shape control of large space structures
N84-23091
HUGHES AIRCRAFT CO., EL SEGUNDO, CALIF.
Advanced nickel-hydrogen cell configuration study
[NASA-CR-173417] N84-22889
HUGHES RESEARCH LABS., MALIBU, CALIF.
Real-time implementation of nonlinear optical processing functions
[AD-A138843] N84-23256

I

IBM FEDERAL SYSTEMS DIV., HOUSTON, TEXAS.
Cleanroom certification model N84-23147
Projecting manpower to attain quality N84-23148
ICF, INC., WASHINGTON, D. C.
The design of information structures: Basic allocation strategies for organizations
[AD-P002909] N84-22861
ICON, INC., SAN DIEGO, CALIF.
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[AD-A138972] N84-22587
IIT RESEARCH INST., ROME, N.Y.
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N84-23149
ILLINOIS UNIV., URBANA.
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[AD-P002887] N84-22849
INDIANA UNIV., BLOOMINGTON.
Toward a theory of library and information science
N84-23405
Time-resolved spectrophotometry of the nova-like cataclysmic variables RW trianguium and UX Urea Majoris N84-23408
INSTITUTE OF OCEANOGRAPHIC SCIENCES, TAUNTON (ENGLAND).
Surface wave propagation over sinusoidally varying topography: Theory and observation
[IOS-159-PT-1] N84-22922
Surface wave propagation over sinusoidally varying topography: Theory and observation
[IOS-159-PT-2] N84-22923
Waves recorded off the Eddystone lighthouse. Data for September 1978 to August 1981 at position 50 deg 10 min N, 004 deg 15 min W: Summary analysis and interpretation report
[IOS-132] N84-23090
INSTITUTO DE PESQUISAS ESPACIAIS, SAO JOSE DOS CAMPOS (BRAZIL).
Stochastic techniques applied to the smoothing treatment of bias and compression of artificial satellite tracking and telemetry data
[INPE-2909-TDL/148] N84-22804
Atmospheric correction study/atmospheric model optimization
[INPE-2969-RPE/448] N84-23040
Influence of extratropical heteorological phenomenon on the northeast Brazilian climate: A study using finite elements
[INPE-2912-PRE/425] N84-23072
A one dimensional model for the study of upwelling
[INPE-2936-RPE/445] N84-23086
Ordered address binary trees: A technique for the optimization of access to trees on disk
[INPE-2916-PRE/428] N84-23133
Study of variability in extragalactic radio sources at 22 GHz and 44 GHz
[INPE-2913-TDL/149] N84-23549
INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION, PARIS (FRANCE).
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[WMO-623] N84-23089
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[AD-A136233] N84-23550
IOWA STATE UNIV. OF SCIENCE AND TECHNOLOGY, AMES.
The government relationship to industry in technology transfer and development
[AD-P002772] N84-23319
IOWA UNIV., IOWA CITY.
Use of MAGSAT anomaly data for crustal structure and mineral resources in the US midcontinent
[E84-10112] N84-23005
A summary of whistlers observed by Voyager 1 at Jupiter
[NASA-CR-173415] N84-23545

J

JAYCOR, SAN DIEGO, CALIF.
Latchup window tests
[AD-A136680] N84-22894
JET PROPULSION LAB., CALIFORNIA INST. OF TECH., PASADENA.
MMH-nitrate and plume deposits from NTO/MMH engines N84-22620
Multiple point source model for three dimensional plume flow fields N84-22625
Very low thrust gaseous oxygen-hydrogen rocket engine ignition technology N84-22692
Instrumentation for sensing moisture content of material using a transient thermal pulse
[NASA-CASE-NPO-15494-2] N84-22935
The Pennsylvania defoliation application pilot test
[E84-10111] N84-23004
Oil shale extraction using super-critical extraction
[NASA-CASE-NPO-15656-1] N84-23012
Chemically rechargeable battery
[NASA-CASE-NPO-16024-1] N84-23020
Topex: Observing the oceans from Space
[NASA-CR-173490] N84-23085

Short time-scale surface changes on Io N84-23447
The planet crossing asteroid survey: Progress in the analysis of populations and terrestrial-planet cratering rates N84-23449
Properties of simulated comet mantle N84-23452
Geomorphic clues to the Martian volatile inventory. 1: Flow ejecta blankets N84-23474
Effusion rate, length, and area relationships for some lava flows on Hawaii and Mount Etna with planetary implications N84-23482
A possible source for the Martian circumpolar dune material N84-23490
Geomorphic clues to the Martian volatile inventory: Landslides N84-23516
Galilean satellite multispectral data base production N84-23521
Is there radar evidence for liquid water on Mars? N84-23529
Correction and geological analysis of lunar 3.8 CM radar data N84-23531
Mapping and geological analysis of Mercury radar data N84-23532
Mercury: Topographic and geologic data from Earth-based radar observations N84-23533

JOINT PUBLICATIONS RESEARCH SERVICE, ARLINGTON, VA.
USSR report: Engineering and equipment [JPRS-UEQ-84-004] N84-22772
Feasibility anlysis of novel technological principles of producing multicomponent mechaniams N84-22773
Dynamic stifness of closed gas-static bearing with regulator N84-22774
Improvement of dynamic characteristics of gas-static bearings N84-22775
Controller for the electro-optical shutter of a dual pulse laser N84-22776
Procedure for wall temperature measurement in a metal vapor laser N84-22777
Hollow cathode cell for pulsed lasers using metal vapors and their chemical compounds N84-22778
Utilizing light focusing by gas discharge medium for stabilization of emission power of He-Ne laser at wavelength of 6401 angstroms N84-22779
Experience with development of sealed linear waveguide electron accelerators N84-22780
Television system for monitoring target position in laser thermonuclear fusion experiments N84-22781
Miniaturized pulsed CO2 laser with sealed electron source N84-22782
Central burst of simultaneously rotating and gravitating body N84-22783
Separation flow past bodies with fixed separation sites N84-22784
Discharge of ideal gas into vacuum N84-22785
More precise numerical simulation of transonic flow through passages in turbomachines N84-22786
Effect of rotation on thermal state of runner blade through effect on heat transfer on coolant side N84-22787
Thermal characteristics of plasma reactors with cylindrical and conical multijet mixing chambers N84-22788
Effect of hydromechanical inertia forces on stability of cylindrical hydrodynamic bearing N84-22789
Exact solution to problem of interaction between wedge moving at supersonic velocity and interface of two gaseous media N84-22790
Theory of hypersonic three-dimensional flow of nonsteady gas stream with relaxation past thin wing with arbitrary aspect ratio N84-22791
Excitation of Tollmin-Schlichting waves in boundary layer at vibrating surface of infinite-span sweptback wing N84-22792
Calculation of apparent masses in blade ring N84-22793
Interaction of unsteady spatial boundary layer with hypersonic flow near rapidly heated portion of surface N84-22794
Hypersonic flow around flat body in case of intense radiative heat exchange N84-22795
Transonic flow around protruding corner with free streamline N84-22796
Wave drag of elongated astroid bodies at moderate supersonic flight velocities N84-22797
Study of large viscoplastic strains in cylindrical shells by method of magnetic-pulse loading N84-22798
Estimation of local stress intensity in flanged thin-wall shell structures under heavy thermal load N84-22799
Stressed-strained state of flanged shells under heavy thermal load beyond elastic limit N84-22800
Plane motion of solid body on rough surface of annular bearing rotating about its axis perpendicular to plane of motion N84-22801
System for torque control of unbalanced rotor during passage through resonance N84-22802
Automatic elimination of static unbalance of rotor in anisotropic bearings N84-22803
Approach to solving problem of acoustic wave diffraction by elastic shell N84-22804
Solving statics problems of thick-walled cylindrical shells with loose contact between layers N84-22805
Apparatus for certification of angular-displacement transducers N84-22806
Measuring roughness of ultrasmooth surfaces by reflectometric method N84-22807
Balancing of flexible rotors with simultaneous precise determination of influencing factors N84-22808
West Europe report: Science and technology [JPRS-WST-84-011] N84-23224
Qualities of SEP ceramic-ceramic Cerasep composites N84-23225
French ONERA acquires U.S. supercomputer for research N84-23226
Thomson semiconductors bipolar IC strategy to 1986 N84-23227
USSR report: Science and technology policy [JPRS-UST-84-004] N84-23387
Incentives for new production discussed N84-23388
Use of economic mechaniams in managing scientific and technical progress N84-23389
Computer developments at Institute of Automation and Electrometry described N84-23390
USSR report: Science and technology policy [JPRS-UST-84-007] N84-23391
Technical and economic indicators for industrial technological institutes N84-23392
Research in man-machine interaction discussed N84-23393
USSR report: Science and technology policy [JPRS-UST-84-005] N84-23394
Prerequisites for scientific-technical progress enumerated N84-23395
Problems of prompt adoption of new technology discussed N84-23396
Landmarks of progress N84-23397

K

KAISER ELECTRONICS, SAN JOSE, CALIF.
En route/terminal ATC (Air Traffic Control) operations concept [AD-A138991] N84-22550

KERNFORSCHUNGSANLAGE, JUELICH (WEST GERMANY).
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KNOLLS ATOMIC POWER LAB., SCHENECTADY, N. Y.
Characterization of zirconium alloy oxidation films by alternating current impedence [DE84-006225] N84-22766

L

LABORATORIUM ELEKTRONISCHE ONTWIKKELINGEN VOOR DE KRIJGSMACHT TNO, OEGSTGEEST (NETHERLANDS).
Coupling of airborne sound in a sandy soil [LEOK-TR-1983-09] N84-23238

LANCASTER UNIV. (ENGLAND).
Theoretical aspects of photoclinometric terrain profiling on the Galilean satellites N84-23441

LEHIGH UNIV., BETHLEHEM, PA.
Corrosion control through a better understanding of the metallic substrate/organic coating/interface [AD-A139086] N84-22739
Experimental observations of vortex ring interaction with the fluid adjacent to a surface [AD-A138999] N84-22917

LIEGE UNIV. (BELGIUM).
Cohomology of the 3-differentiable of the Poisson algebra of a symplectic manifold N84-23175

LINCOLN LAB., MASS. INST. OF TECH., LEXINGTON.
Distributed estimation in the MIT/LL (Massachusetts Institute of Technology/Lincoln Laboratory) DSN (Distributed Sensor Networks) test-bed [AD-P002897] N84-22856
Evaluation of the comprehension of non-continuous, sped-up vocoded speech: A strategy for coping with fading HF (High Frequency) channels [AD-A138650] N84-22871

LITTLE (ARTHUR D.), INC., CAMBRIDGE, MASS.
Heat resistant protective hand covering [NASA-CASE-MSC-20261-2] N84-23113

LOCKHEED ELECTRONICS CO., PLAINFIELD, N. J.
Development of a generalized human-machine interface [AD-P002888] N84-22849

LOCKHEED MISSILES AND SPACE CO., PALO ALTO, CALIF.
Modeling effects of composition on the burn rates of nitrate ester-based energetic binders N84-22685

LOGISTICS MANAGEMENT INST., WASHINGTON, D. C.
Analysis of incentives for productivity-enhancing investment [AD-P002770] N84-23317
Improved management of support resources [AD-P002808] N84-23354
A concept for mission-oriented planning for system acquisition at the Defense Communications Agency [AD-P002823] N84-23368

LOUISIANA STATE UNIV., BATON ROUGE.
Permafrost on Mars: distribution, formation, and geological role N84-23506

M

M/A-COM LINKABIT, INC., SAN DIEGO, CALIF.
Trends in convolutional coding N84-22830

MANAGEMENT CONSULTING AND RESEARCH, INC., FALLS CHURCH, VA.
The problem of cost growth [AD-P002792] N84-23339
Independent cost estimates: A case study joint vertical lift aircraft (JVX) program [AD-P002797] N84-23343

MARTIN MARIETTA CORP., DENVER, COLO.
Manufacturing cost analysis for photovoltaic concentrator tracking structures [DE84-006318] N84-23032

MARYLAND UNIV., COLLEGE PARK.
Asymptotic models for wave scattering from very rough surfaces N84-22683
Incorporation of remotely sensed soil moisture data into a hydrologic runoff model N84-23017
On the generation and use of quantitative criteria for assessing software maintenance quality N84-23128
Current research in the Software Engineering Laboratory (SEL) N84-23138
Monitoring software development through dynamic variables N84-23139
Characteristics of a prototype experiment N84-23140
Structural coverage of functional testing N84-23141
Examining functional acceptance testing with structural coverage metrics N84-23142
Evaluating multiple coordinated windows for programming workstations N84-23146
Strategies and mechanisms for the diffusion of scientific and technical information: A comparative study N84-23406

MASSACHUSETTS INST. OF TECH., CAMBRIDGE.
X-ray photoelectron and Auger electron spectroscopic study of the CdTe surface resulting from various surface pretreatments: Correlations of photoelectrochemical and capacitance-potential behavior with surface chemical composition [AD-A138601] N84-22714
Proceedings of the 6th MIT/ONR (Massachusetts Institute of Technology/Office of Naval Research) Workshop on C3 (Command, Control, and Communications) Systems [AD-A138614] N84-22835
Information processing and decisionmaking organizations: A mathematical description [AD-P002878] N84-22839
A model for asynchronous distributed computation [AD-P002879] N84-22840
Information theoretic models of memory in human decisionmaking models [AD-P002883] N84-22844
Optimal maneuver detection and estimation in multiobject tracking [AD-P002899] N84-22858
A framework for evaluation of surveillance algorithms [AD-P002901] N84-22859
The design of information structures: Basic allocation strategies for organizations [AD-P002909] N84-22861
Optimal file allocation problems for distributed data bases in unreliable computer networks, 2 [AD-P002913] N84-22864
Linear dynamics of cables and chains N84-22978
Human factors in space telepresence [NASA-CR-173420] N84-23119
Implementation of an optimal multicommodity network flow algorithm based on gradient projection and a path flow formulation [AD-A138935] N84-23154
Empirical analysis of a token ring network [AD-A138905] N84-23164

Precise measurement of refractive index and absorption coefficient of near millimeter wave and far infrared materials
[AD-A136656] N84-23253
InP materials
[AD-A136992] N84-23262
Differential degradation of Martian impact basins N84-23468
Elysium Region, Mars: Characterization of tectonic features N84-23534

MASSACHUSETTS UNIV., AMHERST.
Deformation studies of polymers by Fourier transform infrared spectroscopy N84-22751
Method of initial functions for thick shells N84-22996
Stratigraphic, geochemical, and petrologic studies of the Ammonoosuc volcanics, northcentral Massachusetts and southwestern New Hampshire N84-23059
Model reference adaptive control systems: The hybrid approach N84-23169
MM-wavelength measurements of CO in the atmosphere of Mars and SO2 in the atmosphere of Venus N84-23429
Ice-covered volcanic water flows on Ganymede N84-23432
New maps of Lakshmi Planum and eastern Aphrodite, Venus N84-23457
A case for olivine on Mars N84-23520
Interpretation of planetary stress systems: Determination of tectonic over-printing in Northwest Wyoming N84-23540

MATHEMATICAL GEOSCIENCES, INC., LEXINGTON, MASS.
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[AD-A137993] N84-23046

MATHEMATISCH CENTRUM, AMSTERDAM (NETHERLANDS).
A survey of three language-independent programming environments
[MC-IW-240/83] N84-23160
An N to the 1.618th power lower bound on the time to simulate one queue or two pushdown stores by one tape
[MC-IW-245/83] N84-23161
Factoring multivariate integral polynominals
[MC-IW-229/83] N84-23190
Factoring multivariate integral polynomials, part 2
[MC-IW-230/83-PT-2] N84-23191
On orthogonal polynomials on a half line and the associated kernel polynomials
[MC-BW-182/83] N84-23192
Symmetric systems with semisimple structure algebra: The quaternionic case
[NASA-CR-173421] N84-23193
The equicontinuous structure relation and extension of functions defined on G-spaces
[MC-ZW-192/83] N84-23194
Linear multistep methods with minimized truncation error for periodic initial value problems
[MC-NW-157/83] N84-23195
Compactness in semantics for merge and fair merge
[MC-IW-238/83] N84-23199
Big omega versus the wild functions
[MC-IW-239/83] N84-23200
Polynomial factorization by root approximation
[MC-IW-242/83] N84-23201
Distributed elections in an Archimedean ring of processors (preliminary version)
[MC-IW-243/83] N84-23202
The simple roots of real-time computation hierarchies (preliminary version)
[MC-IW-244/83] N84-23203
Bifurcation of map resonance 1 : 4
[MC-TW-245/83] N84-23204
Local bifurcation of a logistic delay map
[MC-TW-246/83] N84-23205
A note on the overflow process from a finite Markovian queue
[MC-BW-179/83] N84-23211
Stochastic dynamical systems with a cyclic structure
[MC-TW-247/83] N84-23214
A framework for the probabilistic analysis of hierarchial planning systems
[MC-BW-180/83] N84-23216
Some analytical aspects of the peakedness concept
[MC-BW-183/83] N84-23217
Process algebra semantics for queues
[MC-IW-241/83] N84-23219
Connectivity of circulant digraphs
[MC-BW-186/83] N84-23220
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[MC-ZW-193/83] N84-23221
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[MC-TW-248/83] N84-23223

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[IPP-6/230/] N84-23262

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[MPIS-4/1983] N84-22730
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[MPIS-7/1983] N84-22731
Experimental investigations of rivulet meanders
[MPIS-5/1983] N84-23015
Aerodynamic sound generation by turbulent boundary layer flow along solid and compliant walls
[MPIS-116/1983] N84-23239
Electronically excited products in the reactions of O(3PJ) atoms with halogenated ethenes
[MPIS-8/1983] N84-23244
Primary patterns of electronically excited molecules in the gas phase 2
[MPIS-9/1983] N84-23245

MIAMI UNIV., FLA.
Modeling of inhalation administration of vapors with capacity limited clearance
[AD-A138847] N84-23096

MICHIGAN UNIV., ANN ARBOR.
Optimal maneuvers of orbital transfer vehicles N84-22606
Microwave curing of composites N84-22708
Adaptive array combined with spread spectrum in communications N84-22825
Strength of bolted joints in laminated composites N84-22992
The vertical redistribution of a pollutant tracer due to cumulus convection N84-23057
Estimating monthly rainfall from geostationary satellite imagery over Amazonia, Brazil N84-23069
Detection of dotted forms in a structured visual noise environment
[AD-A138853] N84-23108
Adaptive control strategies for computer-controlled manipulators N84-23114
Dynamics and evolution of cD galaxies N84-23425
Martian paleoclimate N84-23427
Measurement and analysis of diffuse solar irradiance N84-23546

MICHIGAN UNIV., FLINT.
Wind erosion and dune formation on high frozen bluffs N84-23493

MINNESOTA UNIV., MINNEAPOLIS.
Film cooling on a gas turbine blade near the end wall
[AD-A138794] N84-22569
Wave attenuation in periodic structures
[AD-A138924] N84-22984

MISSISSIPPI UNIV., UNIVERSITY.
Scattering of an electromagnetic plane wave from a perfectly electrically conducting half-plane in the proximity of planar media discontinuities
[AD-A138966] N84-22676

MISSOURI UNIV., COLUMBIA.
Image compression: A 2-dimensional run-length coding N84-23162

MITRE CORP., BEDFORD, MASS.
Local network wideband interconnection alternatives
[AD-A138604] N84-22668

MITRE CORP., MCLEAN, VA.
System safety study of minimum TCAS II (Traffic Alert and Collision Avoidance System)
[AD-A138674] N84-22548
Software for explicitly probabilistic mathematics
[AD-P002881] N84-22642

MORTON THIOKOL, BRIGHAM CITY, UTAH.
Acoustic and photoelectric burnout detection of T-burner grains N84-22650
Combustion of high-aluminum-content propellants N84-22661

N

NAGOYA UNIV. (JAPAN).
A classical picture of anomalous effects in a Tokamak
[IPPJ-664] N84-23263
External excitation of ion cyclotron drift waves in a two-ion species plasma
[IPPJ-665] N84-23264
Moving ring reactor KARIN-I
[IPPJ-660] N84-23265

NATIONAL ACADEMY OF SCIENCES - NATIONAL RESEARCH COUNCIL, WASHINGTON, D. C.
Current trends in atomic spectroscopy
[PB84-162957] N84-22732
Phosphorus-containing imide resins
[NASA-CASE-ARC-11368-3] N84-22745
Priorities for detailed quality assessments of the National Defense Stockpile nonfuel materials
[NMAB-403] N84-23011

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, WASHINGTON, D. C.
NASA Thesaurus supplement. Part 1: Hierarchical listing
[NASA-SP-7051(SUPPL-1)] N84-23398
Reports of planetary geology program, 1983
[NASA-TM-86246] N84-23431
Cratering history of the Saturnian satellites N84-23473

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. AMES RESEARCH CENTER, MOFFETT FIELD, CALIF.
V/STOL concepts in the United States: Past, present, and future
[NASA-TM-85938] N84-22532
Numerical simulation of the tip vortex off a low-aspect-ratio wing at transonic speed
[NASA-TM-85932] N84-22535
Assessment of aerodynamic performance of V/STOL and STOVL fighter aircraft
[NASA-TM-85937] N84-22536
Preliminary experience with a stereoscopic video system in a remotely piloted aircraft application
[NASA-TM-84909] N84-22557
Frequency encoded auditory display of the critical tracking task
[NASA-TM-85889] N84-22558
V/STOL maneuverability and control
[NASA-TM-85939] N84-22584
A formulation and analysis of combat games
[NASA-TM-85927] N84-22585
Space station architecture, module, berthing hub, shell assembly, berthing mechanism and utility connection channel
[NASA-CASE-ARC-11505-1] N84-22612
Fire and heat resistant laminating resins based on maleimido substituted aromatic cyclotriphosphazenes
[NASA-CASE-ARC-11428-1] N84-22697
Process for preparing perfluorotriazine elastomers and precursors thereof
[NASA-CASE-ARC-11402-1] N84-22744
Phosphorus-containing imide resins
[NASA-CASE-ARC-11368-3] N84-22745
Carboranylmethylene-substituted phosphazenes and polymers thereof
[NASA-CASE-ARC-11370-1] N84-22750
Turbulence modeling
[NASA-TM-85889] N84-22913
Electronic scanning pressure measuring system and transducer package
[NASA-CASE-ARC-11381-1] N84-22934
Modulated voltage metastable ionization detector
[NASA-CASE-ARC-11503-1] N84-23093
Far-IR spectroscopy of the galactic center: Neutral and ionized gas in the central 10 pc of the galaxy
[NASA-CR-166510] N84-23411
Origin and evolution of the Saturn system N84-23433
Geologic studies of outer solar system satellites: Iapetus and Europa N84-23448
The Borealis Basin of Mars N84-23472
Long range transport of fine grained sediments on Mars: Atmospheric dust loading, as inferred from Viking Lander imaging data N84-23488

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. HUGH L. DRYDEN FLIGHT RESEARCH CENTER, EDWARDS, CALIF.
Preliminary experience with a stereoscopic video system in a remotely piloted aircraft application
[NASA-TM-84909] N84-22557

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. GODDARD SPACE FLIGHT CENTER, GREENBELT, MD.
Navigation system and method
[NASA-CASE-GSC-12508-1] N84-22546
Experimental investigation of the low NO/sub x vortex airblast annular combustor
[NASA-TM-83615] N84-22567
Review of the effects of microstructure on fatigue in aluminum alloys
[NASA-TM-83626] N84-22735

Low noise tuned amplifier
[NASA-CASE-GSC-12567-1] N84-22687
Energetics of the magnetosphere, revised
[NASA-TM-86063] N84-23041
Software Engineering Laboratory (SEL) data base reporting software user's guide and system description. Volume 1: Introduction and user's guide
[NASA-TM-85809] N84-23129
Software Engineering Laboratory (SEL) data base reporting software user's guide and system description. Volume 2: Program descriptions
[NASA-TM-85809] N84-23130
Glossary of Software Engineering Laboratory terms
[NASA-TM-85808] N84-23135
An approach to software cost estimation
[NASA-TM-85807] N84-23136
Proceedings of the Eighth Annual Software Engineering Workshop
[NASA-TM-85445] N84-23137
Managers handbook for software development
[NASA-TM-85804] N84-23150
Dual aperture multispectral Schmidt objective
[NASA-CASE-GSC-12756-1] N84-23248
Documentation for the machine-readable version of a supplement to the Bright Star catalogue (Hoffleit, Saladyga and Wlasuk 1983)
[NASA-TM-85573] N84-23415
Documentation for the machine-readable version of the catalogue of 20457 Star positions obtained by photography in the declination zone -48 deg to -54 deg (1950)
[NASA-TM-85572] N84-23416
Documentation for the machine-readable version of a table of Redshifts for Abell clusters (Sarazin, Rood and Struble 1982)
[NASA-TM-85571] N84-23417
Documentation for the machine-readable version of the SAO-HD-GC-DM cross index version 1983
[NASA-TM-85570] N84-23418
Documentation for the machine-readable version of the Smithsonian Astrophysical Observatory Star catalogue (SAO) version 1984
[NASA-TM-85574] N84-23419
Documentation for the machine-readable version of the general catalogue of 33342 stars for the epoch 1950 (Boss 1937)
[NASA-TM-85568] N84-23420
Documentation for the machine-readable version of the Survey of the Astrographic Catalogue From 1 to 31 Degrees of Northern Declination (Fresneau 1983)
[NASA-TM-85569] N84-23421
The reaction NH2 + PH3 yields NH3 + PH2: Absolute rate constant measurement and implication for NH3 and PH3 photochemistry in the atmosphere of Jupiter
[NASA-TM-85063] N84-23430
Distribution and properties of small volcanoes in Acidalia Planitia N84-23478

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. LYNDON B. JOHNSON SPACE CENTER, HOUSTON, TEX.

Device and method for frictionally testing materials for ignitability
[NASA-CASE-MSC-20622-1] N84-22596
Satellite Services Catalog: Tools and equipment
[NASA-TM-85627] N84-22597
Pre-stressed thermal protection systems
[NASA-CASE-MSC-20254-1] N84-22601
Apparatus for releasably connecting first and second objects in predetermined space relationship
[NASA-CASE-MSC-18980-1] N84-22605
Tanker orbit transfer vehicle and method
[NASA-CASE-MSC-20543-1] N84-22610
Constant force friction damper
[NASA-CASE-MSC-20505-1] N84-22611
Operational update to the RCS flow field of the space shuttle orbiter N84-22626
Doppler radar having phase modulation of both transmitted and reflected return signals
[NASA-CASE-MSC-18675-1] N84-22620
Heat resistant protective hand covering
[NASA-CASE-MSC-20261-2] N84-23113
Light transmitting window assembly
[NASA-CASE-MSC-18417-1] N84-23251
Caleras in the solar system N84-23485
Weathered stony meteorites from Victoria Land, Antarctica, as possible guides to rock weathering on Mars N84-23509
Salts in the dry valleys of Antartica N84-23510

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. LANGLEY RESEARCH CENTER, HAMPTON, VA.

Slotted variable camber flap
[NASA-CASE-LAR-12541-1] N84-22551
Development and analysis of a STOL supersonic cruise fighter concept
[NASA-TM-85777] N84-22553
Numerical predictions of residence times behind a rearward facing step with transverse injection N84-22687
Thermoset-thermoplastic aromatic polyamide containing N-propargyl groups
[NASA-CASE-LAR-12723-2] N84-22748
Ethynyl and substituted ethynyl-terminated polysulfones
[NASA-CASE-LAR-12931-1] N84-22747
Polyphenylene ethers with imide linking groups
[NASA-CASE-LAR-12990-1] N84-22749
An analysis of shock coalescence including three-dimensional effects with application to sonic boom extrapolation
[NASA-TP-2214] N84-22906
Hybrid perturbation/Bubnov-Galerkin technique for nonlinear thermal analysis
[NASA-TP-2145] N84-22907
Ultrasonic transducer with Gaussian radial pressure distribution
[NASA-CASE-LAR-12967-1] N84-22932
Acoustic ground impedance meter
[NASA-CASE-LAR-12995-1] N84-22933
Prediction of fatigue crack-growth patterns and lives in three-dimensional cracked bodies
[NASA-TM-85787] N84-22979
Photoelectrochemical cells including chalcogenophosphate photoelectrodes
[NASA-CASE-LAR-12958-1] N84-23019

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. LEWIS RESEARCH CENTER, CLEVELAND, OHIO.

Analysis of inviscid and viscous flows in cascades with an explicit multiple-grid algorithm
[NASA-TM-83636] N84-22527
Redesign and cascade tests of a supercritical controlled diffusion stator blade-section
[NASA-TM-83635] N84-22533
Real time pressure signal system for a rotary engine
[NASA-CASE-LEW-13622-1] N84-22559
Tip cap for a rotor blade
[NASA-CASE-LEW-13654-1] N84-22560
Dual clearance squeeze film damper
[NASA-CASE-LEW-13506-1] N84-22562
Oxidizing seal for a turbine tip gas path
[NASA-CASE-LEW-14053-1] N84-22563
Comparison between measured turbine stage performance and the predicted performance using quasi-3D flow and boundary layer analyses
[NASA-TM-83640] N84-22564
Preliminary investigation of a two-zone swirl flow combustor
[NASA-TM-83637] N84-22565
Determination of compressor in-stall characteristics from engine surge transients
[NASA-TM-83639] N84-22566
High voltage-high power components for large space power distribution systems
[NASA-TM-83648] N84-22615
Cathode degradation and erosion in high pressure arc discharges
[NASA-TM-83638] N84-22631
Diamondlike flake composites
[NASA-CASE-LEW-13837-1] N84-22695
Diamondlike flakes
[NASA-CASE-LEW-13837-2] N84-22696
Chemical approach for controlling nadimide cure temperature and rate
[NASA-CASE-LEW-13770-3] N84-22698
Chemical approach for controlling nadimide cure temperature and rate
[NASA-CASE-LEW-13770-4] N84-22699
Chemical approach for controlling nadimide cure temperature and rate
[NASA-CASE-LEW-13770-5] N84-22700
Chemical approach for controlling nadimide cure temperature and rate
[NASA-CASE-LEW-13770-6] N84-22701
Select fiber composites for space applications: A mechanistic assessment
[NASA-TM-83631] N84-22702
Separator development and testing of nickel-hydrogen cells
[NASA-TM-83653] N84-22712
Method of making a light weight battery plaque
[NASA-CASE-LEW-13349-1] N84-22734
Aeronautics and Space Engineering Board: Aeronautics Assessment Committee
[NASA-TM-85594] N84-22771
Radiation damage and defect behavior in ion-implanted, lithium counterdoped silicon solar cells
[NASA-TM-83646] N84-22890
Advances in solid state switchgear technology for large space power systems
[NASA-TM-83652] N84-22891
Development of high frequency low weight power magnetics for aerospace power systems
[NASA-TM-83656] N84-22892
Vortex generating flow passage design for increased film-cooling effectiveness and surface coverage
[NASA-TM-83617] N84-22909
Aerodynamic effect of combustor inlet-air pressure on fuel jet atomization
[NASA-TM-83611] N84-22910
Heat transfer in serpentine passages with turbulence promoters
[NASA-TM-83614] N84-22911
Multicolor printing plate joining
[NASA-CASE-LEW-13598-1] N84-22930
Method and apparatus for coating substrates using a laser
[NASA-CASE-LEW-13526-1] N84-22944
Method of fabricating an abradable gas path seal
[NASA-CASE-LEW-13269-2] N84-22957
Heat pipes to reduce engine exhaust emissions
[NASA-CASE-LEW-12590-1] N84-22958
Improved compliant hydrodynamic fluid journal bearing
[NASA-CASE-LEW-13670-1] N84-22959
A 37.5-kW point design comparison of the nickel-cadmium battery, bipolar nickel-hydrogen battery, and regenerative hydrogen-oxygen fuel cell energy storage subsystems for low Earth orbit
[NASA-TM-83651] N84-23022
Design considerations for a 10-kW integrated hydrogen-oxygen regenerative fuel cell system
[NASA-TM-83664] N84-23023
Design of a 1-kWh bipolar nickel hydrogen battery
[NASA-TM-83647] N84-23024
Advanced designs for IPV nickel-hydrogen cells
[NASA-TM-83643] N84-23025
Teardown analysis of a ten cell bipolar nickel-hydrogen battery
[NASA-TM-83618] N84-23026
The effect of diffusion induced lattice stress on the open-circuit voltage in silicon solar cells
[NASA-TM-83667] N84-23027
Method of making an ion beam sputter-etched ventricular catheter for hydrocephalus shunt
[NASA-CASE-LEW-13107-2] N84-23095
Fan noise reduction achieved by removing tip flow irregularities behind the rotor - forward arc test configurations
[NASA-TM-83616] N84-23235
Government - contractor interaction
[AD-P002768] N84-23315

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. MARSHALL SPACE FLIGHT CENTER, HUNTSVILLE, ALA.

Space probe/satellite ejection apparatus for spacecraft
[NASA-CASE-MFS-15429-1] N84-22609
Method for sequentially processing a multi-level interconnect circuit in a vacuum chamber
[NASA-CASE-MFS-256704-1] N84-22884
Three phase power factor controller
[NASA-CASE-MFS-25535-2] N84-22885
Motor power control circuit for ac induction motors
[NASA-CASE-MFS-25323-1] N84-22886
Bellows flow-induced vibrations
[NASA-TM-82556] N84-22912
Two-dimensional scanner apparatus
[NASA-CASE-MFS-25687-1] N84-22928
Method of and apparatus for double-exposure holographic interferometry
[NASA-CASE-MFS-25405-1] N84-22929
A statistical evaluation and comparison of VISSR Atmospheric Sounder (VAS) data and corresponding rawinsonde measurements
[NASA-TM-82575] N84-23071
Application of VISSR Atmospheric Sounder (VAS) data
[NASA-TM-82574] N84-23073

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. PASADENA OFFICE, CALIF.

Supercritical solvent coal extraction
[NASA-CASE-NPO-15210-1] N84-22709
Absorbable-susceptor joining of ceramic surfaces
[NASA-CASE-NPO-15640-1] N84-22748
Radiative cooler
[NASA-CASE-NPO-15485-1] N84-22903
Method and apparatus for precision control of radiometer
[NASA-CASE-NPO-15398-1] N84-22931
Instrumentation for sensing moisture content of material using a transient thermal pulse
[NASA-CASE-NPO-15494-2] N84-22935
Spectrophone stabilized laser with line center offset frequency control
[NASA-CASE-NPO-15516-1] N84-22943
Oil shale extraction using super-critical extraction
[NASA-CASE-NPO-15656-1] N84-23012

Wind and solar powered turbine
[NASA-CASE-NPO-15496-1] N84-23018
Chemically rechargeable battery
[NASA-CASE-NPO-16024-1] N84-23020
Acoustic rotation control
[NASA-CASE-NPO-15669-1] N84-23233
Programmable scan/read circuitry for charge coupled device imaging detectors
[NASA-CASE-NPO-15345-1] N84-23247

NATIONAL AEROSPACE LAB., AMSTERDAM (NETHERLANDS).
Reprogrammable onboard mission of IRAS
[NLR-MP-83014-U] N84-22600
The application of cold worked holes (in aircraft structures)
[NLR-TR-81120-U] N84-22990
Comparison of processor arrays with pipeline processors for image processing
[NLR-MP-83011-U] N84-23165

NATIONAL AIR AND SPACE MUSEUM, WASHINGTON, D.C.
Morphology of buried craters: Lava thickness estimates by simulated flooding N84-23471
Compressional features in the Tharsis Region of Mars: Geographic N84-23538
Compressional features in the Tharsis Region of Mars: Orientations and Timing of Deformation N84-23539

NATIONAL ENGINEERING LAB., EAST KILBRIDE (SCOTLAND).
Flow measurement facilities at NEL on 1 August 1983
[NEL-686] N84-22924

NATIONAL MECHANICAL ENGINEERING RESEARCH INST., PRETORIA (SOUTH AFRICA).
Work capsule for lightweight hydrostatic machines
[CSIR-RR-581] N84-22905

NATIONAL RESEARCH COUNCIL OF CANADA, OTTAWA (ONTARIO).
The Laplacian resonance and tidal dissipation N84-23434

NATIONAL RESEARCH INST. FOR MATHEMATICAL SCIENCES, PRETORIA (SOUTH AFRICA).
Variable selection in heteroscedastic discriminant analysis
[CSIR-TWISK-283] N84-23171

NAVAL AEROSPACE MEDICAL RESEARCH LAB., PENSACOLA, FLA.
The use of a small digital computer for on-line behavioral experiments
[AD-A138975] N84-23126

NAVAL AIR DEVELOPMENT CENTER, WARMINSTER, PA.
A Generalized Escape System Simulation (GESS) computer program: GESS user's guide, version 2, volume 1
[AD-A138844] N84-22545
The curing of a bisphenol A type epoxy resin with 1,8 Diamino-P-Menthane
[AD-A138977] N84-22761
Corrosion and load transfer effects on fatigue of mechanically fastened joints. Fatigue of zero load transfer specimen
[AD-A139042] N84-22985
Factors affecting human tolerance to sustained acceleration
[AD-A138520] N84-23101

NAVAL AIR REWORK FACILITY, NORFOLK, VA.
New initiatives in international programs
[AD-P002813] N84-23359

NAVAL AIR SYSTEMS COMMAND, WASHINGTON, D. C.
Multi-year procurement a 'Team approach'
[AD-P002780] N84-23327

NAVAL ELECTRONIC SYSTEMS COMMAND, WASHINGTON, D. C.
Doing C2 (Command Control) experiments using war games
[AD-P002875] N84-22836
Mortality and spareparts: A conceptual analysis
[AD-P002826] N84-23371

NAVAL HEALTH RESEARCH CENTER, SAN DIEGO, CALIF.
Cognitive performance change during a 6-hour hike at low temperature in simulated rain, at controlled walking rates
[AD-A138358] N84-23100

NAVAL OCEAN SYSTEMS CENTER, SAN DIEGO, CALIF.
A unified approach to modeling and combining of evidence through random set theory
[AD-P002880] N84-22841
A man-machine interface concept for a state-of-art, shipboard, command/control console
[AD-P002894] N84-22854

NAVAL ORDNANCE STATION, INDIAN HEAD, MD.
Tangential mode instability in double-base solid rocket motors: A case study N84-22652

NAVAL POSTGRADUATE SCHOOL, MONTEREY, CALIF.
Educational aids in aircraft combat survivability
[AD-A139090] N84-22556
An investigation of experimental techniques for obtaining particulate behavior in metallized solid propellant combustion N84-22659
Three-dimensional, primitive-variable model for solid-fuel ramjet combustion N84-22688
Three-dimensional, primitive-variable model for solid-fuel ramjet combustion
[AD-A138756] N84-22715
The heat treatment response of thermomechanically processed M-50 steel
[AD-A138571] N84-22736
Lanchester's equations and game theory
[AD-P002877] N84-22838
Investigation of non-linear estimation of natural resonances in target identification
[AD-A139027] N84-22878
Underwater shock-induced responses of submerged cylindrical structures
[AD-A139072] N84-22987
Coherence study of geomagnetic fluctuations in frequency range .04 - 0.6 HZ between remote land sites
[AD-A138542] N84-23042
The effect of interior motion on seasonal thermocline evolution
[AD-A138270] N84-23088
Documentation for software maintenance
[AD-A138663] N84-23152
Contractor 'Hungriness' and the relative profitability of DoD business
[AD-P002796] N84-23342

NAVAL RESEARCH LAB., WASHINGTON, D. C.
A novel X-ray backlighting method for Rayleigh-Taylor instability measurements on ablatively driven targets
[AD-A138644] N84-22937
Spectroscopic measurements of the Laser-HANE plasma
[AD-A138685] N84-22947
Absolutely uniform illumination of laser fusion pellets
[AD-A138944] N84-22951
Introduction to the Laser-HANE experiment and summary of low-pressure interaction results
[AD-A138945] N84-22952
Rayleigh-Taylor instability in the presence of a stratified shear layer
[AD-A138544] N84-23043
Long wavelength limit of interchange instabilities
[AD-A138943] N84-23047
The electron density and temperature in the photoionized background gas (N2) surrounding a laser produced plasma
[AD-A138651] N84-23266

NAVAL SEA SYSTEMS COMMAND, WASHINGTON, D.C.
Selection of multiple sources in weapon systems acquisition
[AD-P002837] N84-23382

NAVAL SHIP RESEARCH AND DEVELOPMENT CENTER, BETHESDA, MD.
NASTEK: Interactive display of NASTRAN-generated plots
[AD-A138831] N84-22983

NAVAL SURFACE WEAPONS CENTER, WHITE OAK, MD.
Moisture transport in composites during repair work
[AD-A138658] N84-22703
Effect of pressure on the static and dynamic acoustic properties of porous rubber
[AD-A138744] N84-22756
Grit blasting a distributed roughness based on a 30% probability of exceedence
[AD-A138779] N84-22809
The beam-density effect on energy loss of a relativistic charged particle beam
[AD-A139051] N84-23241

NAVAL UNDERWATER SYSTEMS CENTER, NEW LONDON, CONN.
New formulas for HED (Horizontal Electric Dipole), HMD (Horizontal Magnetic Dipole), VED (Vertical Electric Dipole), and VMD (Vertical Magnetic Dipole) subsurface-to-subsurface propagation
[AD-A139030] N84-23187
New formulas that extend Norton's farfield elementary dipole equations to the quasi-nearfield range
[AD-A139057] N84-23188

NAVAL WEAPONS CENTER, CHINA LAKE, CALIF.
Analysis of acoustic chamber pressure oscillations in shuttle high-pressure SRB's N84-22651
Condensed phase temperature profiles in deflagrating HMX N84-22657
Modeling the self-deflagration of HMX N84-22682
Detailed flow measurements in fuel-rich, particle-laden plumes N84-22690
Reactively steered adaptive array (Reesa) N84-22826

NAVY PERSONNEL RESEARCH AND DEVELOPMENT CENTER, SAN DIEGO, CALIF.
Decision and display analysis in a simple surveillance problem
[AD-P002886] N84-22847

NEW MEXICO UNIV., ALBUQUERQUE.
Physics of high temperature, dense plasmas
[AD-A138872] N84-23268
Chronology, morphology and stratigraphy of pumiceous pyroclastic-flow (Ignimbrite) deposits from the eruption of Mount St. Helens on 18 May 1983 N84-23476
Classification of volcanoes of the Kane Patera Quadrangle of Io: Proportions of lava flows and pyroclastic flows N84-23477
A regression model for the temporal development of soil pipes and associated gullies in the alluvial-fill valley of the Rio Puerco, central New Mexico N84-23502

NEW YORK CITY TECHNICAL COLL., BROOKLYN, N.Y.
Dependence of hydromagnetic energy spectra on interplanetary parameters
[AD-A138745] N84-23209

NEW YORK STATE UNIV., BINGHAMTON.
Testability of VLSI (Very Large Scale Integration) leakage faults in CMOS (Complementary Metal Oxide Semiconductor)
[AD-A138978] N84-23261

NORTH CAROLINA STATE UNIV., RALEIGH.
Model identification and parameter estimation of the power, lift, and drag of light aircraft from a single maneuver N84-22552
Parametric and nonparametric Fast Kalman echo cancellation N84-22901

NORTH DAKOTA UNIV., GRAND FORKS.
Volcanic forms in the Kane Patera region, Io N84-23437

NORTHEASTERN UNIV., BOSTON, MASS.
Signal processing circuit development
[AD-A138648] N84-22870

NORTHWESTERN UNIV., EVANSTON, ILL.
An approach to control the evolution of software systems N84-23127
The representation and synthesis of design specifications for distributed software systems N84-23163
Order-preserving dynamic hashing schemes for associative searching in data base systems N84-23400

NOTRE DAME UNIV., IND.
An experimental and analytic study of the flow subsonic wind tunnel inlets
[AD-A138665] N84-22540
The make or buy decision--its nature and impact
[AD-P002779] N84-23326
Increasing the Contractor/Subcontractor/Vendor bidding lists
[AD-P002836] N84-23381

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OAK RIDGE NATIONAL LAB., TENN.
High resolution ultrasonic densitometer
[DE84-003387] N84-22939
Options for an ignited tokamak
[DE84-007927] N84-23272

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[ESA-TT-823] N84-22589

OFFICE OF NAVAL INTELLIGENCE, WASHINGTON, D. C.
Multi-sensor fusion, communications and information warfare
[AD-P002895] N84-22855

OFFICE OF NAVAL RESEARCH, LONDON (ENGLAND).
Fast Electrical and Optical Diagnostic Principles and Techniques: A NATO Advanced Study Institute
[AD-A138598] N84-22936
A survey of European robotics research
[AD-A138952] N84-23122
Statistics and operations research in Europe--1983
[AD-A138953] N84-23215

OFFICE OF THE UNDER SECRETARY OF DEFENSE FOR RESEARCH AND ENGINEERING, WASHINGTON, D. C.
Report of the DOD-University forum working group on engineering and science education
[AD-A138205] N84-23292
The industrial modernization incentives program: An experimental effort to improve defense contractor productivity
[AD-P002771] N84-23318

Contract requirements: A key to controlling DoD acquisition costs
[AD-P002628] N84-23373

OHIO STATE UNIV., COLUMBUS.
Ultrasonic methods to study shadow boundaries of diffracting cracks. Ultrasonic caustics in NDE (Non-Destructive Evaluation)
[AD-A138839] N84-22970
Expert systems for price analysis: A feasibility study
[AD-P002795] N84-23341
An intelligent manual for price analysis
[AD-P002798] N84-23344

OKLAHOMA CITY AIR LOGISTICS CENTER, TINKER AFB, OKLA.
Training acquisition personnel through a local college
[AD-P002766] N84-23313
Reshaping the philosophy of spare parts acquisition: Project PACER PRICE
[AD-P002791] N84-23338

OKLAHOMA STATE UNIV., STILLWATER.
Transient three-dimensional predictions of turbulent flows in cylindrical and cartesian coordinate systems N84-22927
A discrete-element analysis for large deflection of thin plates: A combined effect of geometric and material nonlinearities N84-22995

OKLAHOMA UNIV., NORMAN.
New theory for thick, composite-material rings
[AD-A138536] N84-22981
Ability and expertise in act generation
[AD-A137973] N84-23110
Problem analysis and definition in act generation
[AD-A137978] N84-23111

OPEN UNIV., MILTON (ENGLAND).
Acoustic-to-Seismic coupling over porous ground surfaces
[AD-A138753] N84-23046

OREGON STATE UNIV., CORVALLIS.
Neutron radiographic study of liquid propellant combustion N84-22689
On a simple adaptive tracking filter
[AD-A138955] N84-23186
Undersea sound speed and range estimation
[AD-A138954] N84-23237
Experiments examining the shapes of isolated bars in comparison with those occurring in braided rivers N84-23503
The erosion of streamlined islands, longitudinal grooves and scour marks: Implications to the origin of the Martian outflow channels N84-23504

OULU UNIV. (FINLAND).
Observations of short period magnetic pulsations during the SBARMO-79 campaign: Data summary
[REPT-90/1982] N84-23052
Quick-look tables of continuous pulsations (Pc1) and Intervals of Pulsations of Diminishing Periods (IPDP) magnetic pulsation events recorded in Finland during IMS years 1976-1979: Data summary
[REPT-92/1982] N84-23053

P

PACIFIC SOUTHWEST FOREST AND RANGE EXPERIMENT STATION, BERKELEY, CALIF.
WNDCOM: Estimating surface winds in mountainous terrain
[PB84-157700] N84-23083

PANNATONI (RONALD F.), MORRISTOWN, N.J.
A new eigenfunction expansion and its application to waveguide acoustics
[AD-A138946] N84-23236

PARIS-SUD UNIV., ORSAY (FRANCE).
The Fourier Plancherel transform of the analytic Lie group. 1: Weyl algebras and differential operators N84-23176

PARIS UNIV., ORSAY (FRANCE).
Anomalous laser induced bunch lengthening on the ACO storage ring free electron laser
[AD-A138614] N84-22949
UV and VUV degradation of very high reflectivity mirrors for use in a storage ring free electron laser
[AD-A138740] N84-23255

PEL, INC., BATON ROUGE, LA.
Risk analysis: Comparing different contract types
[AD-P002788] N84-23335

PENNSYLVANIA STATE UNIV., UNIVERSITY PARK.
Direct measurement of high frequency solid propellant response functions N84-22649
Nitramine propellant ignition under rapid gas loading conditions N84-22677
On the limiting electrode potential in cavities and its role in deciding between SCC (Stress Corrosion Cracking) and HC (Hydrogen Cracking) in metals
[AD-A138585] N84-22713
Organometallic chemistry of weakly solvated transition metal cations
[DE84-006987] N84-22726
Carboranylmethylene-substituted phosphazenes and polymers thereof
[NASA-CASE-ARC-11370-1] N84-22750
Electrical, chemical, and microstructural characterization of gettering mechanisms for VLSI (Very Large Scale Integrated Circuits)
[AD-A138662] N84-22893
State space method for optimal design of shock absorbers with floating boundaries N84-22966
Geology and geochronology of the southeast border of the Bitterroot Dome: Implications for the structural evolution of the Mylonitic Carapace N84-23065
Safety eye protection through use of fast acting optical switching
[AD-A138582] N84-23120
H alpha and TiO band observations of RS CVn stars N84-23410

PENNSYLVANIA UNIV., PHILADELPHIA.
High angular resolution microwave sensing with large, sparse, random arrays
[AD-A138717] N84-22874

PERCEPTRONICS, INC., MENLO PARK, CALIF.
Alternative knowledge acquisition interface structures
[AD-A139019] N84-23109

PERFORMANCE MEASUREMENT ASSOCIATES, INC., VIENNA, VA.
Transformations of software design and code may lead to reduced errors N84-23145

PERKIN-ELMER CORP., DANBURY, CONN.
Optimization of thermal systems with sensitive optics, electronics, and structures
[NASA-CR-3745] N84-22608

PITTSBURGH UNIV., PA.
Application of Magsat lithospheric modeling in South America. Part 1: Processing and interpretation of magnetic and gravity anomaly data
[E84-10115] N84-23008
Project management: Evolution and influence
[AD-P002824] N84-23389

PLANETARY SCIENCE INST., TUCSON, ARIZ.
Does saturation cratering exist in the solar system? N84-23467

PRATT AND WHITNEY AIRCRAFT GROUP, EAST HARTFORD, CONN.
Impact of corporate resource allocation decisions on national security objectives: Dissynergism in aerospace industrial resource planning
[AD-P002801] N84-23347

PRATT AND WHITNEY AIRCRAFT OF CANADA LTD., MISSISSAUGA (ONTARIO).
Alternate fuels combustion research
[AD-A138575] N84-22769

PRINCETON COMBUSTION RESEARCH LABS., INC., N.J.
Fluid-dynamically coupled solid propellant combustion instability - cold flow simulation N84-22644
Asymptotic condensed phase analysis of deflagrating monopropellants with subsurface exothermicity N84-22656

PRINCETON UNIV., N. J.
Transonic flow calculations using triangular finite elements N84-22529
Data acquisition and aerodynamic coefficient estimation at high angles of attack N84-22542
Nearly optimal detection of signals in non-Gaussian noise
[AD-A138657] N84-22872
Effects of transverse loading on the thickness shear resonance frequencies in crystal plates N84-22994
Computer methods for industrial automation and robotics N84-23168
Multi-sensor array time-delay estimation with small phase incoherences
[AD-A138867] N84-23183
The luminosity function of galaxies in CO-12 N84-23424
Dynamical relaxation in stellar systems N84-23426

PUERTO RICO UNIV., RIO PIEDRAS.
An exactly solvable model for ideally polarizable interfaces
[AD-A138719] N84-23182
The ideally polarizable interface: A solvable model and general sum rules
[AD-A138720] N84-23207

PURDUE UNIV., LAFAYETTE, IND.
An optical surface tracking device which determines a solid propellant's burning rate N84-22638
Insitu measurement of burning rate N84-22639
On the oscillatory flowfield in solid rocket motors N84-22645
Effect of non-constant solid phase thermal properties on temperature sensitivity of solid propellant N84-22654
Investigation of combustion characteristics of a high chamber pressure rocket motor N84-22693
Intramolecular electron transfer at metal surfaces. 1. Relative energetics of some corresponding outer- and inner-sphere pathways involving halide and pseudohalide bridging ligands
[AD-A139021] N84-22716
Electron-transfer kinetics of redox centers anchored to metal surfaces: Weak- versus strong-overlap reaction pathways
[AD-A139043] N84-22718
Observation of surface-enhanced Raman scattering for transition-metal hexaammine cations at the outer Helmholtz plane: Implications for enhancement mechanisms at electrochemical interfaces
[AD-A139045] N84-22719
Intramolecular electron transfer at metal surfaces. 2: Comparisons of ligand-bridged CR(3) reduction kinetics at silver versus mercury electrodes
[AD-A139047] N84-22720
Surface-enhanced Raman spectroscopy of electrochemically characterized interfaces. Relations between Raman scattering intensity and surface coverage for simple anionic adsorbates
[AD-A139054] N84-22721
Utility of surface reaction entropies for examining reactant-solvent interactions at electrochemical interfaces. Ferricinium-ferrocene attached to platinum electrodes
[AD-A139055] N84-22722
Redox thermodynamics of surface-bound reactants. Illustrative behavior of Cobalt(3)/(2) macrobicyclic cage complexes
[AD-A139058] N84-22723
A method for evaluating the surface concentrations of 2 like-charged ions simultaneously adsorbed at an electrode-solution interface
[AD-A139074] N84-22724
The influence of specific reactant-solvent interactions on intrinsic activation entropies for outer-sphere electron transfer reactions
[AD-A139081] N84-22725
Application of Magsat lithospheric modeling in South America. Part 1: Processing and interpretation of magnetic and gravity anomaly data
[E84-10115] N84-23008
New techniques for measuring single event related brain potentials
[AD-A138694] N84-23107
Personnel technology: Performance appraisal, a process approach
[AD-A138359] N84-23112
Intramolecular electron transfer at metal surfaces. 3: Influence of bond conjugation on reduction kinetics of Cobalt (3) anchored to metal surfaces via thiophenecarboxylate ligands
[AD-A139066] N84-23242
An experimental estimate of the electron-tunneling distance for some outer-sphere electrochemical reactions
[AD-A139049] N84-23284

R

RCA ASTRO-ELECTRONICS DIV., PRINCETON, N. J.
Information theoretic models of memory in human decisionmaking models
[AD-P002883] N84-22844

RESEARCH AND DATA SYSTEMS, INC., LANHAM, MD.
Users guide for ERB 7 MAT (including the first year quality control)
[NASA-CR-170514] N84-23134

RHODE ISLAND UNIV., KINGSTON.
Boron in the marine atmosphere N84-23038
Fluvial drainage systems: Margaritifer Sinus and Agyre (NC, NE) quadrangles, Mars N84-23497

ROCHESTER INST. OF TECH., N. Y.
LANDSAT 4 band 6 data evaluation
[E84-10119] N84-23009

ROCHESTER UNIV., N. Y.
Fracture toughness processes
[DE84-007244] N84-22989
Computer and database location in designing distributed computer systems N84-23399

ROCKWELL INTERNATIONAL CORP., DOWNEY, CALIF.
Constant force friction damper
[NASA-CASE-MSC-20505-1] N84-22611

ROCKWELL INTERNATIONAL CORP., GOLDEN, COLO.
Performance and size estimating for wind systems foi MF
[DE84-006980] N84-23033

ROCKWELL INTERNATIONAL SCIENCE CENTER, THOUSAND OAKS, CALIF.
Ferroelectric tungsten bronze bulk crystals and epitaxial thin films for electro-optic device applications
[AD-A138693] N84-23278

ROLLS-ROYCE LTD., DERBY (ENGLAND).
Engine reliability through bearing condition monitoring [PNR-90166] N84-22570
Acoustic emission: A brief introduction to some of its uses in the aero engine industry [PNR-90172] N84-22571
Optical gas temperature measurement in gas turbines [PNR-90174] N84-22572
Emissions variability and traversing on production RB211 engines [PNR-90176] N84-22573
Engine affordability [PNR-90178] N84-22574
The development of advanced specimen testing and analysis techniques applied to fracture mechanics lifing of gas turbine components [PNR-90179] N84-22575
Turboprop engine design concepts [PNR-90181] N84-22576
The accelerating pace of advancing aero engine technology [PNR-90191] N84-22577
Helicopter engine technology with particular reference to the Rolls-Royce Gem engine [PNR-90193] N84-22578
Some themes on Rolls-Royce military engine technology. Part 1: Old and new engines for combat aircraft. Part 2: After-burning technology [PNR-90195] N84-22579
Fuel efficient engines for large transport [PNR-90196] N84-22580
Industrial and marine engine derivatives: A spin-off from aviation [PNR-90197] N84-22581
The design and development of a low emissions Transply combustor for the civil Spey engine [PNR-90198] N84-22582
The future for titanium and superalloys [PNR-90175] N84-22742
The cyclic behaviour of a powder Ni-base superalloy [PNR-90182] N84-22743
High temperature adhesives for structural applications: A review [PNR-90171] N84-22787
Multi-small hole drilling by EDM [PNR-90184] N84-22813
Manufacturing influence of design and its importance to successful automation [PNR-90189] N84-22814
A review of advanced manufacturing technology [PNR-90194] N84-22815
Infrared temperature measurements in combustion systems [PNR-90170] N84-22942
Laser drilling of aero engine components [PNR-90185] N84-22956
Cost effectiveness of reliability in the aerospace industry [PNR-90187] N84-22971
SIRE: An integrated reliability and cost model for the aerospace industry [PNR-90192] N84-22972
Proven design + new technology = reliability + economy [PNR-90199] N84-22973
Aircraft noise legislation: An overkill [PNR-90167] N84-23037
A high temperature optical displacement measuring system [PNR-90186] N84-23261
Corporate DP planning: New approaches and new concerns [PNR-90180] N84-23386

ROME AIR DEVELOPMENT CENTER, GRIFFISS AFB, N.Y.
Automating the source selection process [AD-P002835] N84-23380
Beyond the data base: Technology for information resource management [AD-A138840] N84-23402

ROYAL AUSTRALIAN NAVY RESEARCH LAB., EDGECLIFF.
Comparisons of sea-surface temperature obtained from ship and satellite data [AD-A138257] N84-23087

ROYAL NETHERLANDS METEOROLOGICAL INST., DE BILT.
Forecasting the windstorm of 12 May 1983 (Acension Day) [KNMI-TR-43] N84-23079

RUTGERS - THE STATE UNIV., NEW BRUNSWICK, N. J.
High pressure melting and crystallization of Nylon-11 [AD-A138858] N84-22760
Theoretical investigation of three-dimensional shock wave-turbulent boundary layer interactions, part 2 [AD-A138722] N84-22916

S

SAN JOSE STATE UNIV., CALIF.
Process for preparing perfluorotriazine elastomers and precursors thereof [NASA-CASE-ARC-11402-1] N84-22744

SANDIA LABS., ALBUQUERQUE, N. MEX.
Preliminary results of the effects of sewing, packing and parachute deployment on material strength [DE84-006464] N84-22541
Plasma-initiated laser deposition of polycrystalline and monocrystalline silicon films [DE84-005527] N84-22953

SCHOOL OF AEROSPACE MEDICINE, BROOKS AFB, TEX.
Yellow ophthalmic filters in the visual acquisition of aircraft [AD-A138536] N84-23097

SCICON CONSULTANCY INTERNATIONAL LTD., LONDON (ENGLAND).
Command decision makers and their modes of interaction [AD-P002882] N84-22843
The use of reciprocal polar co-ordinates in passive tracking [AD-P002906] N84-22860

SCIENCE APPLICATIONS, INC., BOULDER, COLO.
A rf-induced stability of mirrors with inverted pressure profiles [DE84-007018] N84-23273

SCIENCE APPLICATIONS, INC., CHATSWORTH, CALIF.
Detailed flow measurements in fuel-rich, particle-laden plumes N84-22690

SCIENCE APPLICATIONS, INC., LOS ANGELES, CALIF.
Application of the CONTAM 3 computer model to the prediction of heating, forces, and contamination on a communications satellite N84-22621
CONTAM 3 plus improved CONTAM 3 usability N84-22622

SCIENCE APPLICATIONS, INC., MCLEAN, VA.
Cost realism: Assuring more realistic contractor cost proposals [AD-P002800] N84-23348

SCIENCE APPLICATIONS, INC., SCHAUMBURG, ILL.
Cost estimation model for advanced planetary programs, fourth edition [NASA-CR-173495] N84-22590
Advanced planetary studies [NASA-CR-173496] N84-22591
Comet nucleus sample return mission [NASA-CR-173501] N84-22592
Titan exploration with advanced systems. A study of future mission concepts [NASA-CR-173499] N84-22593
Performance assessment of planetary missions as launched from an orbiting space station [NASA-CR-173498] N84-22594
A review of in situ propellant production techniques for solar system exploration [NASA-CR-173494] N84-22595

SHEFFIELD UNIV. (ENGLAND).
Direct digital control of the electric arc furnace [RR-233] N84-22811
Robustness and sensitivity of Smith predictor controllers for time-delay systems [RR-238] N84-22812
Analysis of the transfer function model of tray-type binary distillation columns with liquid hydraulic delay [RR-234] N84-22816
The effects of widening time constants and increasing time delay on controller design using approximate models [RR-239] N84-22817
Stability and performance deterioration due to modelling errors [RR-236] N84-23166
Parameterization and approximation methods in feedback theory with applications in high gain, fast sampling and cheap optimal control [RR-241] N84-23167
On nonlinear systems and algebraic geometry [RR-240] N84-23196
On systems with spectral cluster points and their relation to H sup p spaces [RR-235] N84-23222

SHOCK AND VIBRATION INFORMATION CENTER (DEFENSE), WASHINGTON, D. C.
The Shock and Vibration Digest, volume 16, no. 3 [AD-A139707] N84-22976

SKF TECHNOLOGY SERVICES, KING OF PRUSSIA, PA.
Development of a 3-D microscale topography system [AD-A138809] N84-23013

SMITHSONIAN ASTROPHYSICAL OBSERVATORY, CAMBRIDGE, MASS.
A normal incidence, high resolution X-ray telescope for solar coronal observations [NASA-CR-173518] N84-23412
Cometary nucleus and active regions N84-23450
The study of the physics of cometary nuclei [NASA-CR-173519] N84-23543

SOLAR TURBINES INTERNATIONAL, SAN DIEGO, CALIF.
Heat/mass flow enhancement design for a metal hydride assembly, phase 2 [DE84-007182] N84-22920

SOUTH DAKOTA SCHOOL OF MINES AND TECHNOLOGY, RAPID CITY.
Characterization of humidity sensors and physical properties of h20 [AD-A139024] N84-22938

SOUTHAMPTON UNIV. (ENGLAND).
The design and operational development of self-streamlining 2-dimensional flexible walled test sections [NASA-CR-172328] N84-22534
Heat/mass flow enhancement design for a metal hydride assembly, phase 2 [DE84-007182] N84-22920

SPECTRON DEVELOPMENT LABS., INC., COSTA MESA, CALIF.
Temperature, concentration, and size measurements in turbulent reactive flows N84-22633

SPEECH COMMUNICATION RESEARCH LAB., LOS ANGELES, CALIF.
Preliminary analysis of automatic speech recognition and synthesis technology [AD-A139976] N84-22877

SRI INTERNATIONAL CORP., MENLO PARK, CALIF.
Propagation effects in satellite-based synthetic aperture radars [AD-A138681] N84-22873
Power transfer for microwave discharges [AD-A138668] N84-23267

STANFORD UNIV., CALIF.
Advanced diagnostics for reacting flows N84-22637
Distributed estimation systems [AD-P002898] N84-22857
Progress and problems in storage ring free electron lasers [AD-A138683] N84-22948
Anomalous laser induced bunch lengthening on the ACO storage ring free electron laser [AD-A138814] N84-22949
Data compression [AD-A138541] N84-23124
UV and VUV degradation of very high reflectivity mirrors for use in a storage ring free electron laser [AD-A138740] N84-23255
RF properties of superconducting A-15 compounds [AD-A139067] N84-23285
The case for aeolian control of meter-scale surface texture on Mars N84-23528

STAR ENTERPRISES, BLOOMINGTON, IND.
Behavioral biology of mammalian reproduction and development for a space station [NASA-CR-173493] N84-23092

STATE UNIV. OF NEW YORK, ALBANY.
Cenozoic tectonics of the Caribbean: Structural and stratigraphic studies in Jamaica and Hispaniola N84-23062
Structure of the Brevard Zone and Blue Ridge near Lenoir, North Carolina, with observations on oblique crenulation cleavage and a preliminary theory for irrotational structures in shear zones N84-23067

STATE UNIV. OF NEW YORK, BUFFALO.
Time optimal digital control of multi-unit paper web dynamics N84-22991
East Butte: A volcanic dome of the Eastern Snake River Plain, Idaho N84-23475

STATE UNIV. OF NEW YORK, STONY BROOK.
Dynamic, hierarchical decision problems [AD-P002912] N84-22863

STOCKHOLM UNIV. (SWEDEN).
Thin sets in nonlinear potential theory N84-23178

STUTTGART UNIV. (WEST GERMANY).
Activities report of the Institut fuer Plasmaforschung N84-23276

SYRACUSE UNIV., N. Y.
Electromagnetic radiation and scattering from a system of conducting bodies interconnected by wires N84-22882
An error-specific approach to testing N84-23143

T

TALLY INDUSTRIES, INC., MESA, ARIZ.
Investigation of organic oxidizers for high performance low flame temperature gas generator applications N84-22676

TECHNISCHE HOGESCHOOL, EINDHOVEN (NETHERLANDS).
Measurement and calculation of parameters in the silox diffusion process
[EUT-83-E-133] N84-23289

TELEDYNE CAE, TOLEDO, OHIO.
Variable stator radial turbine
[NASA-CR-174663] N84-22568

TELEFUNKEN ELECTRONIC G.M.B.H., HEILBRONN (WEST GERMANY).
Production oriented 3-5 epitaxy
[BMFT-FB-T-83-266] N84-23290

TENNESSEE UNIV., KNOXVILLE.
State-space structures for the realization of low roundoff noise digital filters N84-22900
Biaxial orientation and mechanical properties of amorphous polymers N84-22965

TEXAS A&M UNIV., COLLEGE STATION.
Chemical properties and film casting of radiation grafted ion-containing polymers
[AD-A136551] N84-22754
CONSERVB: A numerical method to compute soil water content and temperature profiles under a bare surface
[E84-10113] N84-23006
A microwave systems approach to measuring root zone soil moisture
[E84-10114] N84-23007

TEXAS UNIV., AUSTIN.
Quantification of subjective ratings through conjoint measurement analysis
[AD-A136810] N84-22554
Dynamics analysis of electrodynamic satellite tethers. Equations of motion and numerical solution algorithms for the tether
[NASA-CR-171777] N84-22598
Geology, geochemistry, and geochronology of volcanic rocks between Cuauhtemoc and La Junta, central Chihehua, Mexico N84-23066

TEXAS UNIV., EL PASO.
Application of Magsat lithospheric modeling in South America. Part 1: Processing and interpretation of magnetic and gravity anomaly data
[E84-10115] N84-23008

TEXTRON, INC., IRVINE, CALIF.
Technology review of flight crucial flight controls
[NASA-CR-172332] N84-22583

TOHOKU UNIV., SENDAI (JAPAN).
The Record of Electrical and Communication Engineering Conversazione Tohoku University, volume 52, no. 4
[ISSN-0365-7719] N84-23228
All-aluminum-alloy UHV chamber for molecular beam epitaxy, 1 N84-23229
Surface acoustic wave resonators in layered substrates with large electromechanical coupling coefficient N84-23230
Transmitting two-level balanced code within the bandwidth of straight binary code-transmission N84-23231

TOKYO SHIBAURA ELECTRIC CO. LTD. (JAPAN).
Exponential calculus of microdifferential operators of infinite order, part 1 N84-23181

TRANSPORTATION SYSTEMS CENTER, CAMBRIDGE, MASS.
AWOS (Automatic Weather Observing System) sensor evaluation. Transmissometer, forward-scatter meter and lidar ceilometer
[AD-A136743] N84-23074

TRW DEFENSE AND SPACE SYSTEMS GROUP, REDONDO BEACH, CALIF.
Multiple access adaptive antennas N84-22823
Enhancement of spread-spectrum systems through adaptive antenna techniques N84-22824

TRW SPACE TECHNOLOGY LABS., REDONDO BEACH, CALIF.
Three-color pyrometer for burning particle temperature measurement N84-22635
Study of solar array switching power management technology for space power system
[NASA-CR-167890] N84-23021
A summary of whistlers observed by Voyager 1 at Jupiter
[NASA-CR-173415] N84-23545

TRW SYSTEMS AND ENERGY, REDONDO BEACH, CALIF.
Ongoing data reduction, theoretical studies and supporting research in magnetospheric physics
[NASA-CR-173419] N84-23039

TUNIS UNIV. (TUNISIA).
Littlewood Paley's g function associated with a singular differential operator (0, infinity) N84-23180

U

UNITED TECHNOLOGIES CORP., SAN JOSE, CALIF.
Coupling between velocity oscillations and solid propellant combustion N84-22643

UNITED TECHNOLOGIES RESEARCH CENTER, EAST HARTFORD, CONN.
ALESEP: A computer program for the analysis of airfoil leading edge separation bubbles
[NASA-CR-172310] N84-22537

UNIVERSITE DE FRANCHE-COMTE, BRESANCON (FRANCE).
On the Z sub 2 extensions of an imaginary quadratic field N84-23173

UNIVERSITY OF CENTRAL FLORIDA, ORLANDO.
On obtaining physical meaning from the parameters in the Weibull distribution
[AD-A138574] N84-23206
A comparison of several alternatives to maximum likelihood for the Weibull distribution
[AD-A138721] N84-23208

UNIVERSITY OF NORTHEAST LOUISIANA, MONROE.
Progressive impact cratering N84-23469
Inversion of topography in Martian highlands terrains N84-23512

UNIVERSITY OF NORTHERN ARIZONA, FLAGSTAFF.
Relationships and tectonics of the Jg-7 quadrangle of Ganymede N84-23542

UNIVERSITY OF SOUTH FLORIDA, ST. PETERSBURG.
The biochemistry and physiology of bacterial adhesion to surfaces
[AD-A138271] N84-23094

UNIVERSITY OF SOUTHERN CALIFORNIA, LOS ANGELES.
Research Trends in Military Communications
[AD-A138229] N84-22821
A digital adaptive array processing algorithm for communications N84-22834
Assumption of risk in the R and D environment
[AD-P002757] N84-23304
An application of the causal-integrative model
[AD-P002766] N84-23333
Rationalization, standardization and interoperability: Protecting US interests in the process
[AD-P002814] N84-23360

UNIVERSITY OF WESTERN CAROLINA, CULLOWHEE, N.C.
The impact of factory automation and robotics on the contracting and acquisition processes
[AD-P002830] N84-23375

UTAH UNIV., SALT LAKE CITY.
Generation of vehicle wobbling by the unsteady flow field in a spinning solid propellant rocket motor N84-22648
Prediction of atmospheric flow and dispersion over sloping terrain N84-23056

V

VARIAN ASSOCIATES, PALO ALTO, CALIF.
60 GHz gyrotron development program
[DE84-006606] N84-22899
Low-cost GaAs solar cell development
[AD-A138938] N84-23280

VIRGINIA POLYTECHNIC INST. AND STATE UNIV., BLACKSBURG.
Three-dimensional nonequilibrium viscous shock-layer flow over the Space Shuttle orbiter N84-22530
Calculation of the flow over a stalled airfoil N84-22531
Three-dimensional nonequilibrium viscous shock-layer flows over complex reentry vehicles N84-22543
Experimental investigation of the internal flow field in STOL engine inlets N84-22544
Application of control theory to large flexible structures using the independent modal-space control method N84-22617
Active control of distributed structures N84-22618
Measurement of solid propellant burning rates employing microwave techniques N84-22640
Thermoset-thermoplastic aromatic polyamide containing N-propargyl groups
[NASA-CASE-LAR-12723-2] N84-22746
Ultrasonic transducer with Gaussian radial pressure distribution
[NASA-CASE-LAR-12967-1] N84-22932
An evaluation of algorithms for extracting stress intensity factors from photoelastic data for 3 dimensional problems N84-22974
Large deformation behavior of long shallow cylindrical composite panels
[NASA-CR-173286] N84-22975

VIRGINIA UNIV., CHARLOTTESVILLE.
A knowledge based interactive procedure for planning and decision support under uncertainty and parameter imprecision
[AD-P002890] N84-22851
An evaluation of ARIADNE (alternative ranking interactive aid based on dominance structure information elicitation)
[AD-P002891] N84-22852
Award fee contract provisions as a program management tool
[AD-P002776] N84-23323
Quantitative and experimental modelling of sapping networks N84-23500

VTI, INC., DAYTON, OHIO.
A cost based acquisition planning model utilizing expert system concepts
[AD-P002783] N84-23330

W

WASHINGTON UNIV., SEATTLE.
Mixing of swirling flows and behavior of wet flows
[AD-A138697] N84-22915

WASHINGTON UNIV., ST. LOUIS, MO.
Non-destructive evaluation of composite materials using ultrasound
[NASA-CR-173416] N84-22989

WEATHER WING (1ST), HICKAM AFB, HAWAII.
A study of Western North Pacific tropical storms and typhoons that intensify after recurvature
[AD-A138792] N84-23075

WESLEYAN UNIV., MIDDLETOWN, CONN.
Scarp development in the Valles Marineris N84-23515

WESTFAELISCHE WILHELMS UNIV., MUENSTER (WEST GERMANY).
Physical and chemical investigations on real catalyst surfaces
[BMFT-FB-T-83-273] N84-22729

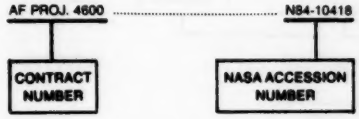
WHITTIER COLL., CALIF.
Glacial and periglacial landforms in Denmark: Scandinavian analogs for Martian features N84-23507
Curvilinear ground on Mars: The search for terrestrial analogs N84-23508
Temporal and spatial distribution of exhumed topography N84-23517

WILLIAMS COLL., WILLIAMSTOWN, MASS.
Near millimeter wave action in n-GaAs
[AD-A138602] N84-23252

WORLD METEOROLOGICAL ORGANIZATION, GENEVA (SWITZERLAND).
World Weather Watch: The plan and implementation program, 1984-1987
[WMO-617] N84-23078
Integrated Global Ocean Services System (IGOSS): Guide to the IGOSS data processing and services system
[WMO-623] N84-23089

WYLE LABS., INC., HUNTSVILLE, ALA.
Acoustic environmental accuracy requirements for response determination
[NASA-CR-171003] N84-23234

Typical Contract Number Index Listing



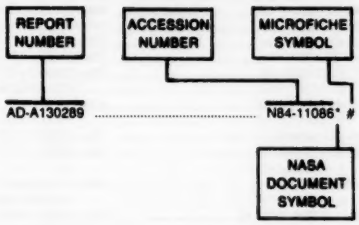
Listings in this index are arranged alphanumerically by contract number. Under each contract number the NASA accession numbers denoting documents that have been produced as a result of research done under that contract are arranged in ascending order. The NASA accession number denotes the number by which the citation is identified.

AF PROJ. LDPP N84-23281
AF PROJ. 1926 ..... N84-22555
N84-22968
AF PROJ. 2003 ..... N84-22528
AF PROJ. 2301 ..... N84-22946
N84-22949
N84-23255
N84-23268
AF PROJ. 2303 ..... N84-22770
AF PROJ. 2305 ..... N84-22869
N84-22874
N84-23184
N84-23254
N84-23256
AF PROJ. 2306 ..... N84-22738
N84-23279
N84-23282
AF PROJ. 2307 ..... N84-22539
N84-22540
N84-22569
N84-22704
N84-22914
N84-22915
N84-22916
N84-22917
AF PROJ. 2311 ..... N84-23209
AF PROJ. 2312 ..... N84-23098
AF PROJ. 2313 ..... N84-22554
N84-23107
AF PROJ. 2421 ..... N84-22762
AF PROJ. 3048 ..... N84-22769
AF PROJ. 3145 ..... N84-23260
AF PROJ. 3201 ..... N84-23048
AF PROJ. 4594 ..... N84-23402
AF PROJ. 4600 ..... N84-22870
N84-22875
AF PROJ. 4643 ..... N84-23044
AF PROJ. 6670 ..... N84-23076
N84-23206
N84-23208
AF PROJ. 6687 ..... N84-23045
AF PROJ. 6690 ..... N84-22599
AF PROJ. 7184 ..... N84-23099
AF PROJ. 7231 ..... N84-23121
AF PROJ. 7381 ..... N84-22762
AF PROJ. 7755 ..... N84-23097
AF PROJ. 7820 ..... N84-22671
AF PROJ. 9993 ..... N84-22616
AF-AFOSR-0012-82 ..... N84-22874
AF-AFOSR-0029-80 ..... N84-22844
AF-AFOSR-0040-82 ..... N84-22916
AF-AFOSR-0048-81 ..... N84-22738
AF-AFOSR-0060-79 ..... N84-23268
AF-AFOSR-0098-80 ..... N84-22863
AF-AFOSR-0111-83 ..... N84-23258
AF-AFOSR-0152-80 ..... N84-23107
AF-AFOSR-0170-81 ..... N84-23254
AF-AFOSR-0172-82 ..... N84-22732
AF-AFOSR-0186-80 ..... N84-22915
AF-AFOSR-0210-81 ..... N84-23098
AF-AFOSR-0220-82 ..... N84-22554
AF-AFOSR-0229-80 ..... N84-22861
AF-AFOSR-0230-80 ..... N84-22914
AF-AFOSR-0265-80 ..... N84-22688
AF-AFOSR-0351-82 ..... N84-23184
AF-AFOSR-3707-78 ..... N84-23209
AFOSR-MIPR-81-0004 ..... N84-22656
AFOSR-NTP-0636 ..... N84-22639
N84-22645
ARPA ORDER 3045 ..... N84-23154
DA PROJ. M01-00-PN N84-22846
DA PROJ. 1L1-61101-A-71A N84-23157
DA PROJ. 1L1-61102-AH-45 ..... N84-22568
DA PROJ. 1T1-61102-BH-57 ..... N84-23046
DA PROJ. 4A1-62720-A-896 ..... N84-22810
DA PROJ. 241-8 ..... N84-22740
DAAG29-80-K-0073 ..... N84-23124
DAAG29-80-K-0082 ..... N84-23252
DAAG29-80-K-0085 ..... N84-22693
DAAG29-81-K-0009 ..... N84-23253
DAAG29-83-M-0065 ..... N84-22821
DAAG46-82-K-0056 ..... N84-23120
DAAK10-78-C-0323 ..... N84-22669
DAAK10-79-C-0221 ..... N84-22669
DAAK10-81-C-0266 ..... N84-22683
DAAK11-80-C-0104 ..... N84-22656
DAAK11-82-C-0053 ..... N84-22662
DAAK11-82-C-0104 ..... N84-23257
DAJA37-81-C-0210 ..... N84-23048
DARPA ORDER 3957 ..... N84-22694
DARPA ORDER 4540 ..... N84-23278
DE-AC02-76CH-00016 ..... N84-22920
DE-AC02-76ERO-3077 ..... N84-23262
DE-AC02-76EV-02360 ..... N84-23036
DE-AC02-81ER-10856 ..... N84-22989
DE-AC02-81ER-10992 ..... N84-22726
DE-AC03-76ET-53057 ..... N84-23273
DE-AC03-76SF-00098 ..... N84-22764
N84-23014
N84-23030
N84-23243
N84-23269
N84-23271
N84-23286
N84-23287
DE-AC04-76DP-00613 ..... N84-22963
DE-AC04-76DP-00789 ..... N84-22541
N84-22953
N84-23031
N84-23032
DE-AC04-76DP-03533 ..... N84-23033
DE-AC07-76ID-01570 ..... N84-22940
DE-AC12-76SN-00052 ..... N84-22766
DE-AC22-80PC-30300 ..... N84-22633
DE-AC22-81PC-40273 ..... N84-22635
DE-AT03-76ER-75016 ..... N84-22765
DE-A01-80RA5236 ..... N84-23193
DNA PROJ. I25-BMXI N84-22952
DNA PROJ. S99-QMXB N84-23047
DNA001-81-C-0010 ..... N84-22673
DNA001-81-C-0281 ..... N84-22894
DTFA01-83-Y-10554 ..... N84-22550
DTFA01-84-C-0001 ..... N84-22548
ESA-4914/18/NL-PP(SC) N84-23081
ESA-4914/81/NL-PP(SC) N84-23080
F41-422 ..... N84-22703
F58-524 ..... N84-23126
F66-412 ..... N84-22983
F68-343 ..... N84-23241
F04611-80-C-0011 ..... N84-22628
F04611-82-C-0041 ..... N84-22630
F04611-82-K-0063 ..... N84-22649
F04611-82-X-0008 ..... N84-22659
F04611-83-C-0029 ..... N84-22622
F04611-83-K-0047 ..... N84-22648
F04611-83-X-0010 ..... N84-22659
F04701-83-C-0084 ..... N84-22538
N84-22897
N84-22950
N84-22982
N84-23548
N84-23550
F19628-80-C-0002 ..... N84-22871
N84-23282
F19628-80-C-0110 ..... N84-22875
F19628-80-C-0127 ..... N84-22616
F19628-80-C-0151 ..... N84-22870
F19628-81-K-0049 ..... N84-22869
F19628-82-C-0001 ..... N84-22868
F19628-82-C-0144 ..... N84-23048
F19628-82-K-0001 ..... N84-23206
N84-23208
F30602-81-C-0222 ..... N84-23281
F30602-81-C-0227 ..... N84-23279
F33615-78-C-3103 ..... N84-22988
F33615-80-C-2002 ..... N84-22769
F33615-80-C-3401 ..... N84-22555
N84-22988
F33615-81-C-1517 ..... N84-22528
F33615-81-C-2025 ..... N84-23280
F33615-81-K-3008 ..... N84-22540
F33615-82-C-0511 ..... N84-23099
F33615-82-C-5039 ..... N84-22762
F33615-82-C-5114 ..... N84-23341
N84-23344
F33615-82-C-5121 ..... N84-23381
F33657-81-C-2150 ..... N84-22637
F49620-78-C-0071 ..... N84-22917
F49620-80-C-0043 ..... N84-22539
F49620-80-C-0068 ..... N84-22946
N84-22949
N84-23255
F49620-81-C-0018 ..... N84-22644
F49620-81-C-0027 ..... N84-22643
F49620-81-C-0066 ..... N84-23256
F49620-82-C-0013 ..... N84-22646
N84-22660
N84-22689
F49620-83-C-0062 ..... N84-22569
F49620-83-K-0004 ..... N84-22637
H42-BAXY N84-22919
I25-BMXI N84-22947
N84-23266
MDA903-81-C-0290 ..... N84-22970
MDA903-81-C-0333 ..... N84-22857
MDA903-83-C-0196 ..... N84-22839
MDA904-82-C-0415 ..... N84-22877
MIPR-FY-1456-81-0014 ..... N84-22704
MR0-4101 ..... N84-23100
NAG-2384 ..... N84-23193
NAGW-135 ..... N84-23544
NAGW-337 ..... N84-23545
NAGW-397 ..... N84-23412
NAGW-440 ..... N84-23520
NAG2-82 ..... N84-23193
NAG3-23 ..... N84-22980
NAG3-295 ..... N84-22753
NAG5-31 ..... N84-23006
N84-23007
NAG5-368 ..... N84-23140
NASA ORDER S-10757-C N84-23003
NASW-3035 ..... N84-22590
N84-22591
NASW-3622 ..... N84-22592
N84-22593
N84-22594
N84-22595
NASW-3690 ..... N84-23039
NASW-3745 ..... N84-23092
NASW-3787 ..... N84-23401
NASW-3797 ..... N84-23119
NAS1-16585 ..... N84-22537
NAS1-17152 ..... N84-22608
NAS1-17403 ..... N84-22583
NAS3-22249 ..... N84-22689
NAS3-22656 ..... N84-23021
NAS3-23163 ..... N84-22568
NAS5-26297 ..... N84-23008
NAS5-26425 ..... N84-23005
NAS5-27323 ..... N84-23009
NAS5-27382 ..... N84-23000
NAS5-27463 ..... N84-22997
NAS5-27728 ..... N84-23134
NAS7-100 ..... N84-22935
N84-23004
N84-23012
NAS7-918 ..... N84-22620

NAS8-33076 ..... N84-22602
NAS8-33379 ..... N84-23234
NAS8-34592 ..... N84-22909
NAS8-34893 ..... N84-22613
N84-22614
NAS8-34909 ..... N84-22960
NAS8-35043 ..... N84-22607
NAS8-35416 ..... N84-22752
NAS9-16151 ..... N84-23028
NAS9-16283 ..... N84-22603
NAS9-16744 ..... N84-22598
NAS10-10541 ..... N84-22768
NCC1-15 ..... N84-22975
NGR-05-003-511 ..... N84-23411
NGR-05-005-055 ..... N84-23413
N84-23414
NSF DMR-82-60638 ..... N84-22633
NSF ECS-81-05984 ..... N84-22663
NSF ECS-82-10673 ..... N84-22663
NSF ECS-82-17688 ..... N84-23154
NSF PHY-82-06076 ..... N84-22732
NSG-1601 ..... N84-22969
NSG-5123 ..... N84-23139
N84-23141
NSG-5266 ..... N84-23007
NSG-7082 ..... N84-23543
NSG-7156 ..... N84-23438
N84-23439
NSG-7172 ..... N84-22534
NSG-7405 ..... N84-23432
N84-23520
NSG-7548 ..... N84-23486
N00014-75-C-0214 ..... N84-22938
N00014-75-C-0540 ..... N84-22760
N00014-75-C-0661 ..... N84-23164
N00014-75-C-0799 ..... N84-22737
N00014-75-C-0860 ..... N84-22714
N00014-75-C-1183 ..... N84-22840
N84-23154
N00014-76-C-0016 ..... N84-23545
N00014-76-C-0408 ..... N84-22757
N84-22758
N00014-77-C-0532 ..... N84-22835
N84-22861
N00014-78-C-0847 ..... N84-22981
N00014-79-C-0323 ..... N84-23155
N00014-79-C-0658 ..... N84-22848
N00014-79-C-0670 ..... N84-22716
N84-22718
N84-22719
N84-22720
N84-22721
N84-22722
N84-22723
N84-22724
N84-22725
N84-23242
N84-23284
N00014-79-C-0731 ..... N84-22739
N00014-79-C-0764 ..... N84-22653
N00014-80-C-0046 ..... N84-22650
N84-22653
N00014-80-C-0479 ..... N84-22694
N00014-80-C-0542 ..... N84-22851
N84-22852
N00014-80-C-0639 ..... N84-23110
N84-23111
N00014-80-C-0670 ..... N84-22759
N00014-81-C-0266 ..... N84-23106
N00014-81-C-0776 ..... N84-23182
N84-23207
N00014-81-K-0025 ..... N84-22713
N00014-81-K-0090 ..... N84-22961
N00014-81-K-0146 ..... N84-22872
N84-23183
N00014-81-K-0256 ..... N84-22876
N00014-81-K-0614 ..... N84-23186
N84-23237
N00014-82-C-0136 ..... N84-22853
N00014-82-C-0342 ..... N84-23013
N00014-82-C-0693 ..... N84-22962
N00014-82-C-2233 ..... N84-22906
N00014-82-C-2468 ..... N84-23276
N00014-82-K-0112 ..... N84-22755
N00014-82-K-0177 ..... N84-22938
N00014-82-K-0449 ..... N84-23112
N00014-82-K-0591 ..... N84-22984
N00014-82-K-0612 ..... N84-22754
N00014-83-C-0230 ..... N84-23236
N00014-83-K-0024 ..... N84-23094
N00014-83-K-0185 ..... N84-22839
N84-22961
N00019-82-C-0157 ..... N84-22967
N00019-82-C-0286 ..... N84-23285
N00019-82-C-0287 ..... N84-23267
N00019-82-C-0456 ..... N84-22658
N00024-83-C-5301 ..... N84-22619
N84-22632
N84-22634
N84-22665
N00030-C-82-C0101 ..... N84-22658
N00174-31-C-0453 ..... N84-22671
N00174-80-C-0316 ..... N84-22662
N00174-81-C-0039 ..... N84-22640
N00174-81-C-0453 ..... N84-22678
N00406-82-D-0875 ..... N84-23237
N61339-82-C-0151 ..... N84-23109
N61339-82-M-0767 ..... N84-22587
PROJ. AGRISTARS N84-23006
N84-23007
RR0-3302 ..... N84-23043
N84-23047
RR0-4208 ..... N84-23112
SERC-GR/B/23250 ..... N84-23166
N84-23167
SURF-851 ..... N84-23167
SWED-NSRC-R-RA-1567-101/102 ..... N84-23198
S99-QAXH N84-22873
S99-QMXB N84-23043
W-31-109-ENG-38 ..... N84-22741
N84-22898
N84-23077
N84-23288
W-7405-ENG-26 ..... N84-22899
N84-22939
N84-23272
W-7405-ENG-48 ..... N84-22705
N84-22706
N84-22954
N84-22982
N84-22984
N84-23259
N84-23260
WDN-S N84-22919
WR0-2204 ..... N84-22703
W1100 ..... N84-22545
X07-92 ..... N84-23187
X99-QAXV N84-22894
ZR0-0001 ..... N84-22985
505-31-3A N84-22533
505-31-3B N84-23235
505-31-01 ..... N84-22535
505-31-17 ..... N84-22913
505-31-23-10 ..... N84-22908
505-31-42 ..... N84-22909
N84-22911
505-31-53-10 ..... N84-22534
505-32-01 ..... N84-22527
505-32-32 ..... N84-22565
505-33-5B N84-22702
505-33-22 ..... N84-22735
N84-22980
505-33-23-02 ..... N84-22979
505-34-11 ..... N84-22585
505-40-5A N84-22566
505-40-22 ..... N84-22910
505-42-11 ..... N84-22558
505-43-01 ..... N84-22532
N84-22536
N84-22584
505-43-43-01 ..... N84-22553
506-53-53-07 ..... N84-22907
506-55-42 ..... N84-22890
N84-23027
506-55-52 ..... N84-22712
N84-23022
N84-23023
N84-23024
N84-23025
N84-23026
506-55-72 ..... N84-22615
N84-22891
N84-22892
533-04-1D N84-22567
535-05-12 ..... N84-22564
605-55-22 ..... N84-22631
677-00-00-03-89 ..... N84-23004

REPORT / ACCESSION NUMBER INDEX

Typical Report / Accession Number Index Listing



Listings in this index are arranged alphanumerically by report number. The NASA accession number denotes the number by which the citation is identified. An asterisk (*) indicates that the item is a NASA report. A pound sign (#) indicates that the item is available on microfiche.

A-9576 ..... N84-22558* #
A-9645 ..... N84-22913* #
A-9678 ..... N84-22585* #
A-9690 ..... N84-22536* #
A-9693 ..... N84-22535* #
A-9695 ..... N84-22532* #
A-9697 ..... N84-22584* #

AD-A137700 ..... N84-23293 #
AD-A137973 ..... N84-23110 #
AD-A137978 ..... N84-23111 #
AD-A137993 ..... N84-23048 #
AD-A138033 ..... N84-22632 #
AD-A138205 ..... N84-23292 #
AD-A138229 ..... N84-22821 #
AD-A138233 ..... N84-23550 #
AD-A138257 ..... N84-23087 #
AD-A138270 ..... N84-23068 #
AD-A138271 ..... N84-23094 #
AD-A138330 ..... N84-23099 #
AD-A138345 ..... N84-23548 #
AD-A138358 ..... N84-23100 #
AD-A138359 ..... N84-23112 #
AD-A138377 ..... N84-23545* #
AD-A138520 ..... N84-23101 #
AD-A138533 ..... N84-23151 #
AD-A138536 ..... N84-23097 #
AD-A138538 ..... N84-22981 #
AD-A138541 ..... N84-23124 #
AD-A138542 ..... N84-23042 #
AD-A138543 ..... N84-22865 #
AD-A138544 ..... N84-23043 #
AD-A138545 ..... N84-22866 #
AD-A138546 ..... N84-22961 #
AD-A138547 ..... N84-22962 #
AD-A138551 ..... N84-22754 #
AD-A138557 ..... N84-22867 #
AD-A138569 ..... N84-22547 #
AD-A138571 ..... N84-22736 #
AD-A138574 ..... N84-23206 #
AD-A138575 ..... N84-22769 #
AD-A138580 ..... N84-22945 #
AD-A138581 ..... N84-22737 #
AD-A138582 ..... N84-23120 #
AD-A138585 ..... N84-22713 #
AD-A138587 ..... N84-22528 #
AD-A138598 ..... N84-22936 #
AD-A138601 ..... N84-22714 #
AD-A138602 ..... N84-23252 #
AD-A138604 ..... N84-22868 #
AD-A138614 ..... N84-22635 #
AD-A138632 ..... N84-22616 #
AD-A138633 ..... N84-23044 #
AD-A138642 ..... N84-23121 #
AD-A138644 ..... N84-22937 #
AD-A138646 ..... N84-23045 #
AD-A138647 ..... N84-22869 #
AD-A138648 ..... N84-22870 #
AD-A138649 ..... N84-22538 #
AD-A138650 ..... N84-22871 #
AD-A138651 ..... N84-23266 #
AD-A138656 ..... N84-23253 #
AD-A138657 ..... N84-22872 #
AD-A138658 ..... N84-22703 #
AD-A138661 ..... N84-22914 #
AD-A138662 ..... N84-22893 #
AD-A138663 ..... N84-23152 #
AD-A138674 ..... N84-22548 #
AD-A138680 ..... N84-22894 #
AD-A138681 ..... N84-22873 #
AD-A138683 ..... N84-22946 #
AD-A138685 ..... N84-22947 #
AD-A138693 ..... N84-23278 #
AD-A138694 ..... N84-23107 #
AD-A138697 ..... N84-22915 #
AD-A138714 ..... N84-22738 #
AD-A138717 ..... N84-22874 #
AD-A138719 ..... N84-23182 #
AD-A138720 ..... N84-23207 #
AD-A138721 ..... N84-23208 #
AD-A138722 ..... N84-22916 #
AD-A138729 ..... N84-22599 #
AD-A138730 ..... N84-22770 #
AD-A138736 ..... N84-23254 #
AD-A138738 ..... N84-22755 #
AD-A138740 ..... N84-23255 #
AD-A138742 ..... N84-22948 #
AD-A138743 ..... N84-23074 #
AD-A138744 ..... N84-22756 #
AD-A138745 ..... N84-23209 #
AD-A138753 ..... N84-23046 #
AD-A138756 ..... N84-22715 #
AD-A138759 ..... N84-22549 #
AD-A138760 ..... N84-22757 #
AD-A138779 ..... N84-22809 #
AD-A138783 ..... N84-22758 #
AD-A138788 ..... N84-22895 #
AD-A138791 ..... N84-22896 #
AD-A138792 ..... N84-23075 #
AD-A138794 ..... N84-22569 #
AD-A138795 ..... N84-22539 #
AD-A138808 ..... N84-22875 #
AD-A138809 ..... N84-23013 #
AD-A138810 ..... N84-22554 #
AD-A138814 ..... N84-22949 #
AD-A138831 ..... N84-22983 #
AD-A138834 ..... N84-22759 #
AD-A138839 ..... N84-22970 #
AD-A138840 ..... N84-23402 #
AD-A138841 ..... N84-23029 #
AD-A138842 ..... N84-22694 #
AD-A138843 ..... N84-23256 #
AD-A138844 ..... N84-22545 #
AD-A138846 ..... N84-23076 #
AD-A138847 ..... N84-23098 #
AD-A138851 ..... N84-23384 #
AD-A138853 ..... N84-23108 #
AD-A138854 ..... N84-23279 #
AD-A138858 ..... N84-22760 #
AD-A138862 ..... N84-22810 #
AD-A138865 ..... N84-22540 #
AD-A138867 ..... N84-23183 #
AD-A138868 ..... N84-23267 #
AD-A138872 ..... N84-23268 #
AD-A138876 ..... N84-23184 #
AD-A138905 ..... N84-23164 #
AD-A138907 ..... N84-23403 #
AD-A138908 ..... N84-23125 #
AD-A138910 ..... N84-22897 #
AD-A138911 ..... N84-22950 #
AD-A138913 ..... N84-23385 #
AD-A138915 ..... N84-23185 #
AD-A138924 ..... N84-22964 #
AD-A138927 ..... N84-23153 #
AD-A138930 ..... N84-22555 #
AD-A138935 ..... N84-23154 #
AD-A138937 ..... N84-23155 #
AD-A138938 ..... N84-23280 #
AD-A138943 ..... N84-23047 #
AD-A138944 ..... N84-22951 #
AD-A138945 ..... N84-22952 #
AD-A138946 ..... N84-23236 #
AD-A138952 ..... N84-23122 #
AD-A138953 ..... N84-23215 #
AD-A138954 ..... N84-23237 #
AD-A138955 ..... N84-23186 #
AD-A138968 ..... N84-22876 #
AD-A138972 ..... N84-22587 #
AD-A138975 ..... N84-23126 #
AD-A138976 ..... N84-22877 #
AD-A138977 ..... N84-22761 #
AD-A138978 ..... N84-23281 #
AD-A138979 ..... N84-23257 #
AD-A138991 ..... N84-22550 #
AD-A138992 ..... N84-23282 #
AD-A138995 ..... N84-23283 #
AD-A138999 ..... N84-22917 #
AD-A139014 ..... N84-23258 #
AD-A139016 ..... N84-22762 #
AD-A139019 ..... N84-23109 #
AD-A139021 ..... N84-22716 #
AD-A139024 ..... N84-22938 #
AD-A139025 ..... N84-23404 #
AD-A139027 ..... N84-22878 #
AD-A139028 ..... N84-23156 #
AD-A139030 ..... N84-23187 #
AD-A139033 ..... N84-23240 #
AD-A139037 ..... N84-23123 #
AD-A139040 ..... N84-22717 #
AD-A139042 ..... N84-22985 #
AD-A139043 ..... N84-22718 #
AD-A139045 ..... N84-22719 #
AD-A139047 ..... N84-22720 #
AD-A139049 ..... N84-23284 #
AD-A139051 ..... N84-23241 #
AD-A139053 ..... N84-23232 #
AD-A139054 ..... N84-22721 #
AD-A139055 ..... N84-22722 #
AD-A139057 ..... N84-23188 #
AD-A139058 ..... N84-22723 #
AD-A139063 ..... N84-22918 #
AD-A139064 ..... N84-22704 #
AD-A139065 ..... N84-22986 #
AD-A139066 ..... N84-23242 #
AD-A139067 ..... N84-23285 #
AD-A139072 ..... N84-22987 #
AD-A139073 ..... N84-22919 #
AD-A139074 ..... N84-22724 #
AD-A139079 ..... N84-22763 #
AD-A139080 ..... N84-23157 #
AD-A139081 ..... N84-22725 #
AD-A139082 ..... N84-22988 #
AD-A139086 ..... N84-22739 #
AD-A139090 ..... N84-22556 #
AD-A139092 ..... N84-22740 #
AD-A139654 ..... N84-22619 #
AD-A139707 ..... N84-22976 #

AD-E001670 ..... N84-22896 #
AD-E301334 ..... N84-22894 #
AD-E301336 ..... N84-22873 #
AD-E401136 ..... N84-22716 #
AD-E401136 ..... N84-22878 #
AD-E401136 ..... N84-22938 #
AD-E401136 ..... N84-23156 #
AD-E401136 ..... N84-23187 #
AD-E401136 ..... N84-23240 #
AD-E401136 ..... N84-23404 #
AD-E750824 ..... N84-23110 #
AD-E750826 ..... N84-23087 #
AD-E850548 ..... N84-23075 #
AD-E950472 ..... N84-23088 #
AD-E950472 ..... N84-23094 #
AD-E950486 ..... N84-23185 #
AD-E950486 ..... N84-23385 #

AD-F300387 ..... N84-22758 #
AD-F300387 ..... N84-22895 #

AD-P002747 ..... N84-23294 #
AD-P002748 ..... N84-23295 #
AD-P002749 ..... N84-23296 #
AD-P002750 ..... N84-23297 #
AD-P002751 ..... N84-23298 #
AD-P002752 ..... N84-23299 #
AD-P002753 ..... N84-23300 #
AD-P002754 ..... N84-23301 #

AD-P002755 ..... N84-23302 #
AD-P002756 ..... N84-23303 #
AD-P002757 ..... N84-23304 #
AD-P002758 ..... N84-23305 #
AD-P002759 ..... N84-23306 #
AD-P002760 ..... N84-23307 #
AD-P002761 ..... N84-23308 #
AD-P002762 ..... N84-23309 #
AD-P002763 ..... N84-23310 #
AD-P002764 ..... N84-23311 #
AD-P002765 ..... N84-23312 #
AD-P002766 ..... N84-23313 #
AD-P002767 ..... N84-23314 #
AD-P002768 ..... N84-23315* #
AD-P002769 ..... N84-23316 #
AD-P002770 ..... N84-23317 #
AD-P002771 ..... N84-23318 #
AD-P002772 ..... N84-23319 #
AD-P002773 ..... N84-23320 #
AD-P002774 ..... N84-23321 #
AD-P002775 ..... N84-23322 #
AD-P002776 ..... N84-23323 #
AD-P002777 ..... N84-23324 #
AD-P002778 ..... N84-23325 #
AD-P002779 ..... N84-23326 #
AD-P002780 ..... N84-23327 #
AD-P002781 ..... N84-23328 #
AD-P002782 ..... N84-23329 #
AD-P002783 ..... N84-23330 #
AD-P002784 ..... N84-23331 #
AD-P002785 ..... N84-23332 #
AD-P002786 ..... N84-23333 #
AD-P002787 ..... N84-23334 #
AD-P002788 ..... N84-23335 #
AD-P002789 ..... N84-23336 #
AD-P002790 ..... N84-23337 #
AD-P002791 ..... N84-23338 #
AD-P002792 ..... N84-23339 #
AD-P002793 ..... N84-23340 #
AD-P002795 ..... N84-23341 #
AD-P002796 ..... N84-23342 #
AD-P002797 ..... N84-23343 #
AD-P002798 ..... N84-23344 #
AD-P002799 ..... N84-23345 #
AD-P002800 ..... N84-23346 #
AD-P002801 ..... N84-23347 #
AD-P002802 ..... N84-23348 #
AD-P002803 ..... N84-23349 #
AD-P002804 ..... N84-23350 #
AD-P002805 ..... N84-23351 #
AD-P002806 ..... N84-23352 #
AD-P002807 ..... N84-23353 #
AD-P002808 ..... N84-23354 #
AD-P002809 ..... N84-23355 #
AD-P002810 ..... N84-23356 #
AD-P002811 ..... N84-23357 #
AD-P002812 ..... N84-23358 #
AD-P002813 ..... N84-23359 #
AD-P002814 ..... N84-23360 #
AD-P002816 ..... N84-23361 #
AD-P002817 ..... N84-23362 #
AD-P002818 ..... N84-23363 #
AD-P002819 ..... N84-23364 #
AD-P002820 ..... N84-23365 #
AD-P002821 ..... N84-23366 #
AD-P002822 ..... N84-23367 #
AD-P002823 ..... N84-23368 #
AD-P002824 ..... N84-23369 #
AD-P002825 ..... N84-23370 #
AD-P002826 ..... N84-23371 #
AD-P002827 ..... N84-23372 #
AD-P002828 ..... N84-23373 #
AD-P002829 ..... N84-23374 #
AD-P002830 ..... N84-23375 #
AD-P002831 ..... N84-23376 #
AD-P002832 ..... N84-23377 #
AD-P002833 ..... N84-23378 #
AD-P002834 ..... N84-23379 #
AD-P002835 ..... N84-23380 #
AD-P002836 ..... N84-23381 #
AD-P002837 ..... N84-23382 #
AD-P002838 ..... N84-23383 #
AD-P002875 ..... N84-22836 #
AD-P002876 ..... N84-22837 #
AD-P002877 ..... N84-22838 #
AD-P002878 ..... N84-22839 #
AD-P002879 ..... N84-22840 #
AD-P002880 ..... N84-22841 #
AD-P002881 ..... N84-22842 #
AD-P002882 ..... N84-22843 #
AD-P002883 ..... N84-22844 #
AD-P002884 ..... N84-22845 #
AD-P002885 ..... N84-22846 #
AD-P002886 ..... N84-22847 #
AD-P002887 ..... N84-22848 #
AD-P002888 ..... N84-22849 #

AD-P002889 ..... N84-22850 #
AD-P002890 ..... N84-22851 #
AD-P002891 ..... N84-22852 #
AD-P002892 ..... N84-22853 #
AD-P002894 ..... N84-22854 #
AD-P002895 ..... N84-22855 #
AD-P002897 ..... N84-22856 #
AD-P002898 ..... N84-22857 #
AD-P002899 ..... N84-22858 #
AD-P002901 ..... N84-22859 #
AD-P002906 ..... N84-22860 #
AD-P002909 ..... N84-22861 #
AD-P002910 ..... N84-22862 #
AD-P002912 ..... N84-22863 #
AD-P002913 ..... N84-22864 #

AEM-RP-84-1 ..... N84-22984 #

AFAMRL-TR-83-066 ..... N84-23099 #
AFAMRL-TR-83-083 ..... N84-23121 #

AFGL-ERP-840 ..... N84-23076 #
AFGL-ERP-859 ..... N84-23044 #
AFGL-ERP-860 ..... N84-23045 #

AFGL-IP-312 ..... N84-22599 #

AFGL-TR-82-0265 ..... N84-22599 #
AFGL-TR-83-0140 ..... N84-22616 #
AFGL-TR-83-0155 ..... N84-23076 #
AFGL-TR-83-0224 ..... N84-23206 #
AFGL-TR-83-0248 ..... N84-23208 #
AFGL-TR-83-0254 ..... N84-23048 #
AFGL-TR-83-0276 ..... N84-23044 #
AFGL-TR-83-0284 ..... N84-23045 #

AFIT/GE/EE/83D-5 ..... N84-22866 #
AFIT/GE/EE/83D-9 ..... N84-22895 #

AFOSR-84-0101TR ..... N84-22946 #
AFOSR-84-0103TR ..... N84-22949 #
AFOSR-84-0105TR ..... N84-23255 #
AFOSR-84-0106TR ..... N84-22915 #
AFOSR-84-0109TR ..... N84-22569 #
AFOSR-84-0110TR ..... N84-22539 #
AFOSR-84-0111TR ..... N84-22738 #
AFOSR-84-0113TR ..... N84-22916 #
AFOSR-84-0115TR ..... N84-22914 #
AFOSR-84-0123TR ..... N84-23209 #
AFOSR-84-0124TR ..... N84-23268 #
AFOSR-84-0125TR ..... N84-23098 #
AFOSR-84-0126TR ..... N84-22554 #
AFOSR-84-0127TR ..... N84-23107 #
AFOSR-84-0130TR ..... N84-22917 #
AFOSR-84-0140TR ..... N84-22674 #
AFOSR-84-0141TR ..... N84-23256 #
AFOSR-84-0142TR ..... N84-23184 #
AFOSR-84-0143TR ..... N84-23254 #

AFRRI-TR-83-3 ..... N84-23240 #

AFSC-TR-82-01 ..... N84-23384 #
AFSC-TR-84-02 ..... N84-23384 #

AFWAL-TR-83-1183 ..... N84-22528 #
AFWAL-TR-83-2057 ..... N84-22769 #
AFWAL-TR-83-2080 ..... N84-23280 #
AFWAL-TR-83-3066 ..... N84-22704 #
AFWAL-TR-83-3106 ..... N84-22555 #
AFWAL-TR-83-3109 ..... N84-22540 #
AFWAL-TR-83-3126 ..... N84-22968 #
AFWAL-TR-83-4125 ..... N84-22762 #
AFWAL-TR-83-4128 ..... N84-22740 #

AFWL-TR-83-51 ..... N84-22919 #

AMMRC-TR-84-3 ..... N84-23120 #

AR-3 ..... N84-22961 #
AR-9 ..... N84-22591* #

ARA-MEMO-246 ..... N84-22561 #

ARCSL-TR-83057 ..... N84-23157 #

ARINC-RES-PUBL-3104-01-TR-3100 ..... N84-23401* #

ARO-17292.7-PH ..... N84-23253 #
ARO-17372.7-EL ..... N84-23124 #
ARO-17546.3-MS ..... N84-22893 #
ARO-17691.2-EL ..... N84-23252 #
ARO-20168.1-EL ..... N84-22821 #

AU-AFIT-LS-1-84 ..... N84-23365 #

AVRADCOM-TR-84-C-6 ..... N84-22564* #

BAE-BT-10658 ..... N84-22586
BAE-BT-10771 ..... N84-23070
BAE-BT-11088 ..... N84-23102
BAE-BT-11172 ..... N84-23170
BAE-BT-11177 ..... N84-23103
BAE-BT-11240 ..... N84-23096
BAE-BT-11241 ..... N84-23104
BAE-BT-11288 ..... N84-23105
BAE-BT-11393 ..... N84-23249
BAE-BT-11729 ..... N84-23131
BAE-BT-11969 ..... N84-23116
BAE-BT-12051 ..... N84-23117
BAE-BT-12363 ..... N84-23118
BAE-BT-12841 ..... N84-23250
BAE-BT-13122 ..... N84-23132
BAE-BT-14588 ..... N84-23106

BAE-821/RES/8631 ..... N84-22904

BBC-RD-1984/1 ..... N84-22618 #
BBC-RD-1984/2 ..... N84-22619 #

BDX-613-3015 ..... N84-22963 #

BLL-M-35526-(5828.4) ..... N84-22733 #

BMFT-FB-T-83-273 ..... N84-22729 #
BMFT-FB-T-83-286 ..... N84-23290 #

BNL-51727 ..... N84-22920 #

CCTC-CSM-UM-246-82-CHG-7 ..... N84-23151 #

CDDF:80-5 ..... N84-22912* #

CERL-TR-E-191 ..... N84-23029 #

CERL-TR-M-339 ..... N84-22810 #

CERL-TR-N-162 ..... N84-23156 #
CERL-TR-N-169 ..... N84-23404 #

CMU-RI-TR-84-1 ..... N84-23123 #
CMU-RI-TR-84-2 ..... N84-23125 #

CONF-830911-38 ..... N84-22954 #
CONF-831015-37 ..... N84-23286 #
CONF-831086-12 ..... N84-22898 #
CONF-831174-64 ..... N84-22953 #
CONF-831174-81 ..... N84-22741 #
CONF-831180-12-REV ..... N84-23243 #
CONF-831195-6 ..... N84-22940 #
CONF-831203-111 ..... N84-23269 #
CONF-831253-8 ..... N84-23030 #
CONF-831253-9 ..... N84-23014 #
CONF-840139-2 ..... N84-23287 #
CONF-840142-2 ..... N84-23271 #
CONF-840405-9 ..... N84-22768 #
CONF-840448-1 ..... N84-22962 #
CONF-840448-2 ..... N84-22964 #
CONF-840459-2 ..... N84-22705 #
CONF-840459-3 ..... N84-22706 #
CONF-840469-1 ..... N84-23077 #
CONF-840494-2 ..... N84-23260 #
CONF-840496-1 ..... N84-22541 #
CONF-840498-1 ..... N84-23259 #
CONF-8311137-1 ..... N84-22939 #
CONF-8404103-1 ..... N84-22764 #
CONF-8404106-1 ..... N84-23288 #

CPIA-PUBL-383-VOL-1 ..... N84-22632 #
CPIA-PUBL-384-VOL-1 ..... N84-22619 #

CRDC-CR-84018 ..... N84-23257 #

CRPE-NT-110 ..... N84-23054 #
CRPE-NT-112-PT-1 ..... N84-23055 #
CRPE-NT-113 ..... N84-22879 #
CRPE-NT-114 ..... N84-23049 #
CRPE-NT-121 ..... N84-22881 #
CRPE-NT-122 ..... N84-22880 #
CRPE-NT-125 ..... N84-23016 #
CRPE-NT-127 ..... N84-23158 #

CSI-83-12-01 ..... N84-22821 #

CSIR-RR-581 ..... N84-22905 #

CSIR-TWISK-283 ..... N84-23171 #

CTH-MATH-1983-10 ..... N84-23210 #
CTH-MATH-1983-15 ..... N84-23198 #
CTH-MATH-1983-16-PREPRINT ..... N84-23189 #
CTH-MATH-1983-17 ..... N84-23212 #
CTH-MATH-1983-24 ..... N84-23218 #
CTH-MATH-1983-30 ..... N84-23213 #

CTH-MATH-1983-82 ..... N84-22926 #
CTH-MATH-1984-1 ..... N84-23246 #
CTH-MATH-198314-PT-3 ..... N84-23197 #

DELNV-TR-0037 ..... N84-22945 #

DE84-002013 ..... N84-22962 #
DE84-003367 ..... N84-22939 #
DE84-004158 ..... N84-22705 #
DE84-004162 ..... N84-22706 #
DE84-005454 ..... N84-22940 #
DE84-005527 ..... N84-22953 #
DE84-005718 ..... N84-23243 #
DE84-005735 ..... N84-23260 #
DE84-005737 ..... N84-23259 #
DE84-005753 ..... N84-23036 #
DE84-006225 ..... N84-22766 #
DE84-006311 ..... N84-22765 #
DE84-006318 ..... N84-23032 #
DE84-006365 ..... N84-23031 #
DE84-006424 ..... N84-23077 #
DE84-006464 ..... N84-22541 #
DE84-006606 ..... N84-22899 #
DE84-006641 ..... N84-22764 #
DE84-006734 ..... N84-22896 #
DE84-006737 ..... N84-23268 #
DE84-006753 ..... N84-23269 #
DE84-006761 ..... N84-23267 #
DE84-006762 ..... N84-23271 #
DE84-006772 ..... N84-23266 #
DE84-006881 ..... N84-23014 #
DE84-006883 ..... N84-23030 #
DE84-006960 ..... N84-23033 #
DE84-006967 ..... N84-22726 #
DE84-007018 ..... N84-23273 #
DE84-007069 ..... N84-23270 #
DE84-007182 ..... N84-22920 #
DE84-007232 ..... N84-22954 #
DE84-007243 ..... N84-22964 #
DE84-007244 ..... N84-22969 #
DE84-007273 ..... N84-22741 #
DE84-007762 ..... N84-22937 #
DE84-007915 ..... N84-22963 #
DE84-007927 ..... N84-23272 #

DFVLR-FB-82-14 ..... N84-22955 #
DFVLR-FB-82-19 ..... N84-22588 #
DFVLR-FB-82-27 ..... N84-23034 #

DMS-DR-2515 ..... N84-22603* #

DNA-TR-81-56 ..... N84-22894 #
DNA-TR-81-253 ..... N84-22873 #

DOE/ER-10856/05 ..... N84-22989 #
DOE/ER-10992/2 ..... N84-22726 #
DOE/ER-75016/T1 ..... N84-22765 #

DOE/EV-02360/1 ..... N84-23036 #

DOE/S-0026 ..... N84-23270 #

DOT-TSC-FAA-82-6 ..... N84-23074 #

DOT/FAA/PM-83/20 ..... N84-23074 #
DOT/FAA/PM-83/36 ..... N84-22548 #

DREO-TN-83-3 ..... N84-22547 #

DRSMI/RG-83-15-TR ..... N84-23185 #

DST-2700Z-001-84 ..... N84-22948 #

DSTZT-83-R-12 ..... N84-22763 #

DTNSRDC/CMLD-84/01 ..... N84-22983 #

D180-27935-1 ..... N84-22614* #
D180-27935-3 ..... N84-22613* #
D180-27951-1 ..... N84-23028* #

E-2000 ..... N84-22631* #
E-2016 ..... N84-23022* #
E-2017 ..... N84-22712* #
E-2029 ..... N84-22565* #
E-2034 ..... N84-22910* #
E-2037 ..... N84-23024* #
E-2040 ..... N84-22911* #
E-2041 ..... N84-23023* #
E-2043 ..... N84-22892* #
E-2046 ..... N84-22567* #
E-2047 ..... N84-23235* #
E-2048 ..... N84-22909* #
E-2051 ..... N84-23026* #
E-2052 ..... N84-23025* #
E-2061 ..... N84-22735* #
E-2065 ..... N84-22564* #
E-2069 ..... N84-22702* #
E-2077 ..... N84-22533* #
E-2078 ..... N84-22527* #
E-2082 ..... N84-22566* #
E-2091 ..... N84-22890* #
E-2093 ..... N84-22615* #
E-2096 ..... N84-22691* #
E-2110 ..... N84-23027* #

EAI-TR-79-004 ..... N84-22602* #

EGG-M-22783 ..... N84-22940 #

ER-599A ..... N84-22608* #

ERA-82-22 ..... N84-22888
ERA-82-91 ..... N84-22967
ERA-82-136 ..... N84-22968

ESA-CR(P)-1832-VOL-1 ..... N84-23080 #
ESA-CR(P)-1832-VOL-2 ..... N84-23081 #

ESA-TT-799 ..... N84-22955 #
ESA-TT-800 ..... N84-22588 #
ESA-TT-807 ..... N84-23034 #
ESA-TT-823 ..... N84-22589 #

ESD-TR-83-222 ..... N84-22868 #
ESD-TR-83-230 ..... N84-22871 #
ESD-TR-83-241 ..... N84-23282 #

ETL-836 ..... N84-23277 #

EUT-83-E-133 ..... N84-23289 #

E84-10094 ..... N84-22997* #
E84-10098 ..... N84-23000* #
E84-10100 ..... N84-23003* #
E84-10111 ..... N84-23004* #
E84-10112 ..... N84-23005* #
E84-10113 ..... N84-23006* #
E84-10114 ..... N84-23007* #
E84-10115 ..... N84-23008* #
E84-10119 ..... N84-23009* #

FAA-AP-83-16 ..... N84-22550 #

FAA-APO-84-1 ..... N84-22549 #

FJSRL-TR-83-0018 ..... N84-22770 #

FM-4 ..... N84-22917 #

FSGTR-PSW-73 ..... N84-23083 #

FTD-ID(RS)T-0031-84 ..... N84-23283 #
FTD-ID(RS)T-1712-83 ..... N84-22717 #
FTD-ID(RS)T-1726-83 ..... N84-23232 #
FTD-ID(RS)T-1863-83 ..... N84-22918 #

GC-TR-83-281 ..... N84-22896 #

GKSS-83-E-42 ..... N84-23035 #
GKSS-83-E-61 ..... N84-23082 #

GL-3675 ..... N84-23285 #

H-1185 ..... N84-22557* #

HEPL-922 ..... N84-23255 #
HEPL-929 ..... N84-22949 #

HR-78500037 ..... N84-22583* #

ICS-8401 ..... N84-23155 #

INPE-2909-TDL/148 ..... N84-22604 #
INPE-2912-PRE/425 ..... N84-23072 #
INPE-2913-TDL/149 ..... N84-23549 #
INPE-2916-PRE/428 ..... N84-23133 #
INPE-2936-RPE/445 ..... N84-23086 #
INPE-2969-RPE/448 ..... N84-23040 #

IOS-132 ..... N84-23090 #
IOS-159-PT-1 ..... N84-22922 #
IOS-159-PT-2 ..... N84-22923 #

IPP-1/220 ..... N84-23262
IPP-6/230/ N84-23262

IPPJ-660 ..... N84-23265 #
IPPJ-664 ..... N84-23263 #
IPPJ-665 ..... N84-23264 #

IR-36 ..... N84-22975* #

ISBN-0-7968-2377-1 ..... N84-22905 #
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JAYCOR-J200-82-447-2249 ..... N84-22894 #

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JPL-PUB-83-65 ..... N84-23004* #

JPL-400-133 ..... N84-23085* #

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JPRS-UST-84-004 ..... N84-23387 #
JPRS-UST-84-005 ..... N84-23394 #
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JSC-19211 ..... N84-22597* #

JUEL-1869 ..... N84-23275 #

KAPL-4174 ..... N84-22766 #

KNMI-TR-43 ..... N84-23079 #

L-15584 ..... N84-22907* #
L-15660 ..... N84-22906* #

LBL-15943 ..... N84-23286 #
LBL-16179 ..... N84-23269 #
LBL-16192 ..... N84-22764 #
LBL-16677 ..... N84-23030 #
LBL-16866-REV ..... N84-23243 #
LBL-17141 ..... N84-23287 #
LBL-17145 ..... N84-23014 #
LBL-17203 ..... N84-23271 #

LEOK-TR-1983-09 ..... N84-23238 #

LIDS-P-1364 ..... N84-23154 #

LIDS-R-1354 ..... N84-22635 #

MC-BW-179/83 ..... N84-23211 #
MC-BW-180/83 ..... N84-23216 #
MC-BW-182/83 ..... N84-23192 #
MC-BW-183/83 ..... N84-23217 #
MC-BW-185/83 ..... N84-23193* #
MC-BW-186/83 ..... N84-23220 #

MC-IW-229/83 ..... N84-23190 #
MC-IW-230/83-PT-2 ..... N84-23191 #
MC-IW-238/83 ..... N84-23199 #
MC-IW-239/83 ..... N84-23200 #
MC-IW-240/83 ..... N84-23160 #
MC-IW-241/83 ..... N84-23219 #
MC-IW-242/83 ..... N84-23201 #
MC-IW-243/83 ..... N84-23202 #
MC-IW-244/83 ..... N84-23203 #
MC-IW-245/83 ..... N84-23161 #

MC-NW-157/83 ..... N84-23195 #

MC-TW-245/83 ..... N84-23204 #

MC-TW-246/83 ..... N84-23205 #
MC-TW-247/83 ..... N84-23214 #
MC-TW-248/83 ..... N84-23223 #

MC-ZW-192/83 ..... N84-23194 #
MC-ZW-193/83 ..... N84-23221 #

MISC-804 ..... N84-22574 #

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MIX/A-3188 ..... N84-23081 #

MPE-PREPRINT-21 ..... N84-23547

MPIS-4/1983 ..... N84-22730 #
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MPIS-7/1983 ..... N84-22731 #
MPIS-8/1983 ..... N84-23244 #
MPIS-9/1983 ..... N84-23245 #
MPIS-116/1983 ..... N84-23239 #

MTR-83W241 ..... N84-22548 #
MTR-8563 ..... N84-22868 #

NADC-83111-60 ..... N84-22545 #
NADC-83133-60 ..... N84-22985 #
NADC-83146-60 ..... N84-22761 #
NADC-84021-60 ..... N84-23101 #

NAMRL-1304 ..... N84-23126 #

NAS 1.15:82556 ..... N84-22912* #
NAS 1.15:82574 ..... N84-23073* #
NAS 1.15:82575 ..... N84-23071* #
NAS 1.15:83611 ..... N84-22910* #
NAS 1.15:83614 ..... N84-22911* #
NAS 1.15:83615 ..... N84-22567* #
NAS 1.15:83616 ..... N84-23235* #
NAS 1.15:83617 ..... N84-22909* #
NAS 1.15:83618 ..... N84-23026* #
NAS 1.15:83626 ..... N84-22735* #
NAS 1.15:83631 ..... N84-22702* #
NAS 1.15:83635 ..... N84-22533* #
NAS 1.15:83636 ..... N84-22527* #
NAS 1.15:83637 ..... N84-22565* #
NAS 1.15:83638 ..... N84-22631* #
NAS 1.15:83639 ..... N84-22566* #
NAS 1.15:83640 ..... N84-22564* #
NAS 1.15:83643 ..... N84-23025* #
NAS 1.15:83646 ..... N84-22890* #
NAS 1.15:83647 ..... N84-23024* #
NAS 1.15:83648 ..... N84-22615* #
NAS 1.15:83651 ..... N84-23022* #
NAS 1.15:83652 ..... N84-22691* #
NAS 1.15:83653 ..... N84-22712* #
NAS 1.15:83656 ..... N84-22892* #
NAS 1.15:83664 ..... N84-23023* #
NAS 1.15:83667 ..... N84-23027* #
NAS 1.15:84909 ..... N84-22557* #
NAS 1.15:85063 ..... N84-23430* #
NAS 1.15:85445 ..... N84-23137* #
NAS 1.15:85568 ..... N84-23420* #
NAS 1.15:85569 ..... N84-23421* #
NAS 1.15:85570 ..... N84-23418* #
NAS 1.15:85571 ..... N84-23417* #
NAS 1.15:85572 ..... N84-23416* #
NAS 1.15:85573 ..... N84-23415* #
NAS 1.15:85574 ..... N84-23419* #
NAS 1.15:85594 ..... N84-22771* #
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NAS 1.15:85606 ..... N84-23135* #
NAS 1.15:85607 ..... N84-23136* #
NAS 1.15:85608 ..... N84-23129*
NAS 1.15:85609 ..... N84-23130*
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NAS 1.15:85777 ..... N84-22553* #
NAS 1.15:85787 ..... N84-22979* #
NAS 1.15:85869 ..... N84-22558* #
NAS 1.15:85889 ..... N84-22913* #
NAS 1.15:85927 ..... N84-22585* #
NAS 1.15:85932 ..... N84-22535* #
NAS 1.15:85937 ..... N84-22536* #
NAS 1.15:85938 ..... N84-22532* #
NAS 1.15:85939 ..... N84-22584* #
NAS 1.15:86063 ..... N84-23041* #
NAS 1.15:86246 ..... N84-23431* #
NAS 1.21:7051(SUPPL-1) N84-23398*
NAS 1.26:3745 ..... N84-22608* #
NAS 1.26:166510 ..... N84-23411* #
NAS 1.26:167684 ..... N84-22603* #
NAS 1.26:167890 ..... N84-23021* #
NAS 1.26:170514 ..... N84-23134* #
NAS 1.26:171003 ..... N84-23234* #
NAS 1.26:171004 ..... N84-22607* #
NAS 1.26:171005 ..... N84-22908* #
NAS 1.26:171008 ..... N84-22960* #
NAS 1.26:171012 ..... N84-22752* #
NAS 1.26:171013 ..... N84-22602* #
NAS 1.26:171014 ..... N84-22614* #
NAS 1.26:171016 ..... N84-22613* #
NAS 1.26:171777 ..... N84-22598* #
NAS 1.26:171780 ..... N84-23028* #
NAS 1.26:172310 ..... N84-22537* #
NAS 1.26:172328 ..... N84-22534* #
NAS 1.26:172332 ..... N84-22583* #
NAS 1.26:173286 ..... N84-22975* #
NAS 1.26:173367 ..... N84-23000* #
NAS 1.26:173369 ..... N84-23003* #
NAS 1.26:173415 ..... N84-23545* #
NAS 1.26:173416 ..... N84-22969* #
NAS 1.26:173417 ..... N84-22889* #
NAS 1.26:173418 ..... N84-23401* #
NAS 1.26:173419 ..... N84-23039* #
NAS 1.26:173420 ..... N84-23119* #
NAS 1.26:173421 ..... N84-23193* #
NAS 1.26:173422 ..... N84-22768* #
NAS 1.26:173480 ..... N84-22997* #
NAS 1.26:173481 ..... N84-23004* #
NAS 1.26:173482 ..... N84-23005* #
NAS 1.26:173483 ..... N84-23006* #
NAS 1.26:173484 ..... N84-23007* #
NAS 1.26:173485 ..... N84-23008* #
NAS 1.26:173489 ..... N84-23009* #
NAS 1.26:173490 ..... N84-23085* #
NAS 1.26:173493 ..... N84-23092* #
NAS 1.26:173494 ..... N84-22595* #
NAS 1.26:173495 ..... N84-22590* #
NAS 1.26:173496 ..... N84-22591* #
NAS 1.26:173497 ..... N84-23544* #
NAS 1.26:173498 ..... N84-22594* #
NAS 1.26:173499 ..... N84-22593* #
NAS 1.26:173500 ..... N84-22753* #
NAS 1.26:173501 ..... N84-22592* #
NAS 1.26:173518 ..... N84-23412* #
NAS 1.26:173519 ..... N84-23543* #
NAS 1.26:173525 ..... N84-23414* #
NAS 1.26:173526 ..... N84-23413* #
NAS 1.26:174634 ..... N84-22980* #
NAS 1.26:174663 ..... N84-22568* #
NAS 1.60:2145 ..... N84-22907* #
NAS 1.60:2214 ..... N84-22906* #

NASA-CASE-ARC-11361-1 ..... N84-22934*
NASA-CASE-ARC-11368-3 ..... N84-22745*
NASA-CASE-ARC-11370-1 ..... N84-22750*
NASA-CASE-ARC-11402-1 ..... N84-22744*
NASA-CASE-ARC-11428-1 ..... N84-22697* #
NASA-CASE-ARC-11503-1 ..... N84-23093* #
NASA-CASE-ARC-11505-1 ..... N84-22612* #

NASA-CASE-GSC-12508-1 ..... N84-22546*
NASA-CASE-GSC-12567-1 ..... N84-22887*
NASA-CASE-GSC-12756-1 ..... N84-23248*

NASA-CASE-LAR-12541-1 ..... N84-22551*
NASA-CASE-LAR-12723-2 ..... N84-22746*
NASA-CASE-LAR-12931-1 ..... N84-22747*
NASA-CASE-LAR-12958-1 ..... N84-23019*
NASA-CASE-LAR-12967-1 ..... N84-22932*
NASA-CASE-LAR-12980-1 ..... N84-22749*
NASA-CASE-LAR-12995-1 ..... N84-22933*

NASA-CASE-LEW-12590-1 ..... N84-22958*
NASA-CASE-LEW-13107-2 ..... N84-23095*
NASA-CASE-LEW-13269-2 ..... N84-22957*
NASA-CASE-LEW-13349-1 ..... N84-22734*
NASA-CASE-LEW-13506-1 ..... N84-22562* #
NASA-CASE-LEW-13526-1 ..... N84-22944*
NASA-CASE-LEW-13598-1 ..... N84-22930*
NASA-CASE-LEW-13622-1 ..... N84-22559*
NASA-CASE-LEW-13654-1 ..... N84-22580*
NASA-CASE-LEW-13670-1 ..... N84-22959* #
NASA-CASE-LEW-13770-3 ..... N84-22698* #
NASA-CASE-LEW-13770-4 ..... N84-22699* #
NASA-CASE-LEW-13770-5 ..... N84-22700* #
NASA-CASE-LEW-13770-6 ..... N84-22701* #
NASA-CASE-LEW-13837-1 ..... N84-22695*
NASA-CASE-LEW-13837-2 ..... N84-22696* #
NASA-CASE-LEW-14053-1 ..... N84-22563* #

NASA-CASE-MFS-15429-1 ..... N84-22609* #
NASA-CASE-MFS-25323-1 ..... N84-22886*
NASA-CASE-MFS-25405-1 ..... N84-22929*
NASA-CASE-MFS-25535-2 ..... N84-22885*
NASA-CASE-MFS-25687-1 ..... N84-22928*
NASA-CASE-MFS-256704-1 ..... N84-22884*

NASA-CASE-MSC-18417-1 ..... N84-23251* #
NASA-CASE-MSC-18675-1 ..... N84-22820*
NASA-CASE-MSC-18969-1 ..... N84-22605*
NASA-CASE-MSC-20254-1 ..... N84-22601*
NASA-CASE-MSC-20261-2 ..... N84-23113*
NASA-CASE-MSC-20505-1 ..... N84-22611* #
NASA-CASE-MSC-20543-1 ..... N84-22610* #
NASA-CASE-MSC-20622-1 ..... N84-22596* #

NASA-CASE-NPO-15210-1 ..... N84-22709*
NASA-CASE-NPO-15345-1 ..... N84-23247*
NASA-CASE-NPO-15398-1 ..... N84-22931*
NASA-CASE-NPO-15465-1 ..... N84-22903*
NASA-CASE-NPO-15494-2 ..... N84-22935* #
NASA-CASE-NPO-15496-1 ..... N84-23018*
NASA-CASE-NPO-15516-1 ..... N84-22943*
NASA-CASE-NPO-15640-1 ..... N84-22748*
NASA-CASE-NPO-15656-1 ..... N84-23012* #
NASA-CASE-NPO-15689-1 ..... N84-23233*
NASA-CASE-NPO-16024-1 ..... N84-23020* #

NASA-CR-3745 ..... N84-22608* #
NASA-CR-166510 ..... N84-23411* #
NASA-CR-167684 ..... N84-22603* #
NASA-CR-167890 ..... N84-23021* #
NASA-CR-170514 ..... N84-23134* #
NASA-CR-171003 ..... N84-23234* #
NASA-CR-171004 ..... N84-22607* #
NASA-CR-171005 ..... N84-22908* #
NASA-CR-171008 ..... N84-22960* #
NASA-CR-171012 ..... N84-22752* #
NASA-CR-171013 ..... N84-22602* #
NASA-CR-171014 ..... N84-22614* #
NASA-CR-171016 ..... N84-22613* #
NASA-CR-171777 ..... N84-22598* #
NASA-CR-171780 ..... N84-23028* #
NASA-CR-172310 ..... N84-22537* #
NASA-CR-172328 ..... N84-22534* #
NASA-CR-172332 ..... N84-22583* #
NASA-CR-173286 ..... N84-22975* #
NASA-CR-173367 ..... N84-23000* #
NASA-CR-173369 ..... N84-23003* #
NASA-CR-173415 ..... N84-23545* #
NASA-CR-173416 ..... N84-22969* #
NASA-CR-173417 ..... N84-22889* #
NASA-CR-173418 ..... N84-23401* #
NASA-CR-173419 ..... N84-23039* #
NASA-CR-173420 ..... N84-23119* #
NASA-CR-173421 ..... N84-23193* #
NASA-CR-173422 ..... N84-22768* #
NASA-CR-173480 ..... N84-22997* #
NASA-CR-173481 ..... N84-23004* #
NASA-CR-173482 ..... N84-23005* #
NASA-CR-173483 ..... N84-23006* #
NASA-CR-173484 ..... N84-23007* #
NASA-CR-173485 ..... N84-23008* #
NASA-CR-173489 ..... N84-23009* #
NASA-CR-173490 ..... N84-23085* #
NASA-CR-173493 ..... N84-23092* #
NASA-CR-173494 ..... N84-22595* #
NASA-CR-173495 ..... N84-22590* #
NASA-CR-173496 ..... N84-22591* #
NASA-CR-173497 ..... N84-23544* #
NASA-CR-173498 ..... N84-22594* #
NASA-CR-173499 ..... N84-22593* #
NASA-CR-173500 ..... N84-22753* #
NASA-CR-173501 ..... N84-22592* #
NASA-CR-173518 ..... N84-23412* #
NASA-CR-173519 ..... N84-23543* #
NASA-CR-173525 ..... N84-23414* #
NASA-CR-173526 ..... N84-23413* #
NASA-CR-174634 ..... N84-22980* #
NASA-CR-174663 ..... N84-22568* #

NASA-SP-7051(SUPPL-1) N84-23398*

NASA-TM-82556 ..... N84-22912* #
NASA-TM-82574 ..... N84-23073* #
NASA-TM-82575 ..... N84-23071* #
NASA-TM-83611 ..... N84-22910* #
NASA-TM-83614 ..... N84-22911* #
NASA-TM-83615 ..... N84-22567* #
NASA-TM-83616 ..... N84-23235* #
NASA-TM-83617 ..... N84-22909* #
NASA-TM-83618 ..... N84-23026* #
NASA-TM-83626 ..... N84-22735* #
NASA-TM-83631 ..... N84-22702* #
NASA-TM-83635 ..... N84-22533* #
NASA-TM-83636 ..... N84-22527* #
NASA-TM-83637 ..... N84-22565* #
NASA-TM-83638 ..... N84-22631* #
NASA-TM-83639 ..... N84-22566* #
NASA-TM-83640 ..... N84-22564* #
NASA-TM-83643 ..... N84-23025* #
NASA-TM-83646 ..... N84-22890* #
NASA-TM-83647 ..... N84-23024* #
NASA-TM-83648 ..... N84-22615* #
NASA-TM-83651 ..... N84-23022* #
NASA-TM-83652 ..... N84-22891* #
NASA-TM-83653 ..... N84-22712* #

NASA-TM-83656 ..... N84-22892* #
NASA-TM-83664 ..... N84-23023* #
NASA-TM-83667 ..... N84-23027* #
NASA-TM-84909 ..... N84-22557* #
NASA-TM-85063 ..... N84-23430* #
NASA-TM-85445 ..... N84-23137* #
NASA-TM-85568 ..... N84-23420* #
NASA-TM-85569 ..... N84-23421* #
NASA-TM-85570 ..... N84-23418* #
NASA-TM-85571 ..... N84-23417* #
NASA-TM-85572 ..... N84-23416* #
NASA-TM-85573 ..... N84-23415* #
NASA-TM-85574 ..... N84-23419* #
NASA-TM-85594 ..... N84-22771* #
NASA-TM-85604 ..... N84-23150* #
NASA-TM-85606 ..... N84-23135* #
NASA-TM-85607 ..... N84-23136* #
NASA-TM-85608 ..... N84-23129*
NASA-TM-85609 ..... N84-23130*
NASA-TM-85627 ..... N84-22597* #
NASA-TM-85777 ..... N84-22553* #
NASA-TM-85787 ..... N84-22979* #
NASA-TM-85869 ..... N84-22558* #
NASA-TM-85889 ..... N84-22913* #
NASA-TM-85927 ..... N84-22585* #
NASA-TM-85932 ..... N84-22535* #
NASA-TM-85937 ..... N84-22536* #
NASA-TM-85938 ..... N84-22532* #
NASA-TM-85939 ..... N84-22584* #
NASA-TM-86063 ..... N84-23041* #
NASA-TM-86246 ..... N84-23431* #

NASA-TP-2145 ..... N84-22907* #
NASA-TP-2214 ..... N84-22906* #

NATICK/TR-84/001 ..... N84-23403 #

NAVHLTHRSCHC-83-32 ..... N84-23100 #

NAVTRAEQUIPC-82-C-0151-1 ..... N84-23109 #
NAVTRAEQUIPC-82-M-0767-1 ..... N84-22587 #

NEL-686 ..... N84-22924 #

NLR-MP-83011-U ..... N84-23165 #
NLR-MP-83014-U ..... N84-22600 #

NLR-TR-81120-U ..... N84-22990 #

NMAB-403 ..... N84-23011 #

NPS-67-84-001 ..... N84-22715 #

NRL-MR-5221 ..... N84-22951 #
NRL-MR-5237 ..... N84-22937 #
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NRL-MR-5268 ..... N84-22952 #
NRL-MR-5270 ..... N84-23266 #
NRL-MR-5274 ..... N84-22947 #

NSSDC/WDC-A-R&S-83-07 ..... N84-23420* #
NSSDC/WDC-A-R&S-83-16 ..... N84-23421* #
NSSDC/WDC-A-R&S-83-17 ..... N84-23418* #
NSSDC/WDC-A-R&S-83-18 ..... N84-23417* #
NSSDC/WDC-A-R&S-83-19 ..... N84-23416* #
NSSDC/WDC-A-R&S-84-02 ..... N84-23419* #
NSSDC/WDC-A-R&S-84-04 ..... N84-23415* #

NSWC/MP-83-444 ..... N84-22809 #

NSWC/TR-83-348 ..... N84-23241 #
NSWC/TR-83-374 ..... N84-22703 #
NSWC/TR-83-450 ..... N84-22756 #

NUSC-TR-6881 ..... N84-23187 #
NUSC-TR-6883 ..... N84-23188 #

ONRL-C-18-83 ..... N84-22936 #

ONRL-R-3-84 ..... N84-23215 #
ONRL-R-4-84 ..... N84-23122 #

ORNL/SUB-79-21453/16 ..... N84-22899 #

ORNL/TM-8924 ..... N84-23272 #

OSU-ONR-TR-83-6 ..... N84-23186 #
OSU-ONR-TR-83-7 ..... N84-23237 #

OU-AMNE-83-4 ..... N84-22981 #

PB84-157700 ..... N84-23083 #
PB84-162957 ..... N84-22732 #

PERLAB-3 ..... N84-23108 #

PHYS-84-1 ..... N84-22938 #

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PNR-90199 ..... N84-22973 #

PP-119 ..... N84-23115

PPAFTR-1131-83-1 ..... N84-23109 #

PREPRINT-611 ..... N84-22925 #

PRI-72 ..... N84-23273 #

QR-5 ..... N84-23000* #
QR-6 ..... N84-23009* #
QR-16 ..... N84-22899 #

RADC-TR-83-128 ..... N84-22875 #
RADC-TR-83-140 ..... N84-22869 #
RADC-TR-83-202 ..... N84-23281 #
RADC-TR-83-210 ..... N84-22870 #
RADC-TR-83-224 ..... N84-23279 #
RADC-TR-83-312 ..... N84-23402 #

RANRL-TM(EXT)-8/83 ..... N84-23087 #

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REPRINT-758 ..... N84-22815 #
REPRINT-870 ..... N84-23037 #
REPRINT-871 ..... N84-22570 #
REPRINT-873 ..... N84-22767 #
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REPRINT-902 ..... N84-22814 #
REPRINT-904 ..... N84-22972 #
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REPRINT-916 ..... N84-22582 #
REPRINT-917 ..... N84-22973 #
REPRINT-919 ..... N84-22579 #

REPT-1WW/TN-83/002 ..... N84-23075 #
REPT-15 ..... N84-23183 #
REPT-21-4140(2) ..... N84-22759 #
REPT-53-4503-9802 ..... N84-22821 #
REPT-83-148 ..... N84-23274 #
REPT-83-149 ..... N84-22941 #
REPT-90/1982 ..... N84-23052 #
REPT-92/1982 ..... N84-23053 #
REPT-240-6176-A ..... N84-23281 #

RFP-3586 ..... N84-23033 #

RR-233 ..... N84-22811 #
RR-234 ..... N84-22816 #
RR-235 ..... N84-23222 #
RR-236 ..... N84-23166 #
RR-238 ..... N84-22812 #
RR-239 ..... N84-22817 #

RR-240 ..... N84-23196 #
RR-241 ..... N84-23167 #

RSC-134 ..... N84-23006* #
RSC-138 ..... N84-23007* #

RU-TR-160-MAE-F ..... N84-22916 #

SAI-A-120-340-S15 ..... N84-22595* #

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SAI-1-120-768-C9 ..... N84-22590* #
SAI-83/1151 ..... N84-22593* #
SAI-83/1152 ..... N84-22592* #
SAI-84-3011 ..... N84-23273 #

SAND-82-7151 ..... N84-23032 #
SAND-83-1416C ..... N84-22953 #
SAND-83-1753C ..... N84-22541 #
SAND-83-7026 ..... N84-23031 #

SAPR-19 ..... N84-23543* #

SAR-3 ..... N84-23412* #

SATR-2 ..... N84-23278 #

SC5340.4SA ..... N84-23278 #

SD-TR-83-77 ..... N84-22897 #
SD-TR-83-81 ..... N84-23548 #
SD-TR-83-86 ..... N84-23550 #
SD-TR-83-87 ..... N84-22982 #
SD-TR-83-92 ..... N84-22950 #

SEL-82-003 ..... N84-23129*
SEL-82-003 ..... N84-23130*
SEL-82-105 ..... N84-23135* #
SEL-83-008 ..... N84-23137* #
SEL-84-001 ..... N84-23150* #

SKF-AT83D011 ..... N84-23013 #

SM-T3-04447 ..... N84-23007* #
SM-T3-04448 ..... N84-23006* #

SR-4 ..... N84-23206 #
SR-5 ..... N84-23208 #

SU-HEPL-923 ..... N84-22948 #

TACOM-TR-12907 ..... N84-23153 #

TDCK-78614 ..... N84-23238 #

TELEDYNE-CAE-1987 ..... N84-22568* #

TR-3 ..... N84-22754 #
TR-8-8-83 ..... N84-23111 #
TR-10 ..... N84-23182 #
TR-11 ..... N84-23207 #
TR-14 ..... N84-22872 #
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TR-17 ..... N84-22718 #
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TR-20 ..... N84-23284 #
TR-21 ..... N84-22725 #
TR-22 ..... N84-22720 #
TR-23 ..... N84-22716 #
TR-24 ..... N84-23242 #
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TR-26 ..... N84-22724 #
TR-26 ..... N84-22760 #
TR-30 ..... N84-22757 #
TR-30-09-83 ..... N84-23110 #
TR-32 ..... N84-22758 #
TR-36 ..... N84-22981 #
TR-41 ..... N84-22714 #
TR-50 ..... N84-22755 #
TR-83-5 ..... N84-23112 #
TR-671 ..... N84-22871 #
TR-753-2 ..... N84-22867 #
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TR-0084(4930-01)-2 ..... N84-22950 #
TR-0084(4935-05)-1 ..... N84-22897 #
TR-0084(4935-05)-2 ..... N84-22982 #
TR-0084(4940-01)-1 ..... N84-23548 #
TR-0084(9975)-2 ..... N84-22538 #

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UCRL-89625 ..... N84-22705 #

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UCRL-89648 ..... N84-22954 #
UCRL-90184 ..... N84-23260 #
UCRL-90220 ..... N84-23259 #
UCRL-90294 ..... N84-22964 #

UDR-TR-82-141 ..... N84-22988 #
UDR-TR-83-70 ..... N84-22555 #
UDR-TR-83-95 ..... N84-22782 #

UI-83-31 ..... N84-23545* #

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US-PATENT-4,377,371 ..... N84-22957*
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